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# The C.F.A. Report

It is difficult to imagine how the ironfoundry section of the industry ever managed without an employers' association of a truly national character, yet the Council of Ironfoundry Associations is but a few years old. Not the least important statement of the Annual Report is contained in the paragraph on "meetings," wherein some idea is given of the representation necessary to ensure that basic requirements of the industry are not neglected. The increase in the operative manpower of the industry, by 21 per cent., is very creditable, but a watch must be kept on the intake of "clerical" staff. At 13 per cent. it is reasonable in view of the modern necessity for form-filling, but there must be no emulation of the Civil Service, though it is obvious that each new addition to the government's bureaucracy must cause a serious multiplicant for his opposite number in industry.

The output of the ironfoundry industry last year was highly praiseworthy, and if only the manufacture of large cast-iron pipes and segments had achieved its pre-war level, an all-time record would easily have been broken.

When we used to dream dreams of the activities of a national employers' federation, we never envisaged the important part it would play in education. C.F.A. has done, at considerable cost, brilliant work in the production of booklets and film strips Details of one of these is now before us. It is called "Lecture Notes for Use with Film Strip or Wall Panels on Foundry Technique—No. 1: Ramming Green-Sand Moulds." It represents "visual education" in its highest form. It seems appropriate to point out that these are available equally to our overseas readers as to those at home on writing to the Secretary of the C.F.A., whose address is given on a later page. They are invaluable alike to schools and foundries employing lads. It is pleasing to read that, at long last, the British Foundry School is to be re-established. This delay is a real blot on the organising ability of the foundry industry and the Ministry of Education.

The remarks as to the importation of castings seem somewhat insignificant at the moment, but in view of what we learn, it can be anticipated that in the not too distant future there will be a clamour for external supplies of cast products, just as there is now for coal. An interesting commentary is that customers will not find them cheap as compared with home prices—at least from Continental sources. For the moment we refrain from commenting on the recently published "Conditions of Sale," but intend to give them consideration later.

Finally but a few remarks are devoted to the fuel shortage because of the period covered. It is now obvious that attenuated supplies can be anticipated for some considerable time, but they may well attune themselves with the rest of the shortages confidently to be envisaged.

We have not yet seen the "Costing Report." If it has managed to cater for both large and small concerns, then it has accomplished much. If it has paved the way for the launching of a nationally unified costing system, then it has, indeed, sealed the success of the C.F.A. Most of the first misfortunes of the industry can be ascribed to faulty costing or the entire lack of its application.

It is now abundantly clear that every foundry benefits from the activities of the C.F.A. and it is obviously incumbent upon every concern within the industry to acknowledge this help by joining his appropriate organisation. It should not be necessary to point out that the C.F.A. does not include "wages" within its activities, but we still find misconceptions existing here and there.

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## *Forthcoming . . . . . Events*

*(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)*

APRIL 3.

*Institute of Production Engineers (Nottingham Branch)* :—"History of the Large Internal Combustion Engine," by H. J. Gibbons, at Victoria Station Hotel, Nottingham, at 7 p.m.

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APRIL 9.

*Institution of Production Engineers* :—"Shot Peening," by W. Neville, at Central Library, Luton, at 7 p.m.

APRIL 10.

*Institute of Metals* :—"New Testing Methods for Metals," by H. J. Curnow, R. A. Mintern, and D. O. Sproule, at 4, Grosvenor Gardens, London, S.W.1, at 7 p.m.

*Institution of Production Engineers* :—"Gear Manufacture and Inspection," by F. J. Everest, M.Sc., at Station Hotel, Dudley, at 7 p.m.

**Institute of British Foundrymen**

APRIL 12.

*West Yorks Branch* :—Prize winning Paper in S. W. Wise memorial competition at Technical College, Bradford, at 6.30 p.m.

## Reports on German Industry

The B.I.O.S. Information Section latest announcement lists the following reports of interest to our readers. The cost, post-free, is given. B.I.O.S. 798—The German Ferro Alloy Industry (8/9); B.I.O.S. 866 (3/2); B.I.O.S. 1081 Silicon Tetrachloride and Related Products, Silicones, Silicic Acid Esters. Finely Divided Silica (3/8) and F.I.A.T. 889 Metallurgical and Industrial Developments in Magnesia. They can be purchased from H.M. Stationery Office, P.O., Box 509, London, S.E.1, or at the provincial offices.

## *A Swedish Casting*

When the Swedish art founder P. G. Bergman recently visited the U.S.A., he took with him a couple of spruce twigs cast in bronze. The bronze twigs constitute an example of what is claimed to be a new casting method. He tied two twigs together with a thin sewing thread, which he forgot to remove before casting. The thread was also reproduced in the cast, and one can clearly see where it has been cut off.

[We remember seeing in 1912 castings of this type carried out in silver. They were made in Germany! —Editor.]

## B.C.I.R.A. New Members

The British Cast Iron Research Association have elected the following firms as ordinary members. The name of the official representative is shown in brackets.

Agarwal Iron Works, Agra, India (Mr. M. P. Agarwal).

S. Jellyman, Limited, Cannock (Mr. R. H. Minns).

## One-off Castings

*By "Chip"*

Production of one-off castings is a regular feature of jobbing foundry work and ways and means have to be adopted to avoid excessive pattern costs, even to the extent of throwing extra work on the moulds.

Foundries attached to engineering works, handling a regular run of standard castings, are sometimes called upon to produce, at short notice, a casting out of standard. For example, a fairly heavy flywheel was required urgently and no suitable pattern was available. The first suggestion was to strike up a mould in loam, but this idea was turned down because heavy building plates would have been necessary to construct the mould, and because a loam mould would require careful drying, which would have taken too long in this particular case.

The method ultimately adopted was to find a pattern of the nearest size to the casting required and set the moulders on ramming up a mould. In the meantime, the patternmaker prepared a segmental building piece which was subsequently used to adjust the mould to the size of the special wheel required, and the mould was thus completed in a very short time. The moulding time was longer than if a special pattern had been prepared, but the cost was much less.

## *Old Locomotive for Newcastle Museum*

A locomotive which has been in continuous service for nearly seventy years is to be exhibted in the Newcastle Science and Engineering Museum. It is an 0-4-0 Black Hawthorne, the only surviving example of the earliest type of industrial locomotive designed by that company. It was built in 1874 and used at a works in Hebburn until 1943, when the works was closed. It was then sold to George Cohen, Sons & Company, Limited, of London and Leeds, for dismantling and disposal, and they presented it to the North Eastern Historical Engineering and Industrial Society, who were anxious that it should be saved from the scrap-heap. It was still capable of pulling a substantial load.

The makers, Black, Hawthorne & Company, were a firm of Gateshead engineers, established in 1866. The business changed hands in 1898 and was eventually closed down in 1902.

## U.S.A. Metal Production

It is reported from America that of the important metals, only magnesium, with production probably jumping from 20,000,000 lbs., in 1946 to 30,000,000 lbs., this year, will outrun demand, pegged at 20,000,000 lbs. Non-ferrous metals, after the price upheavals late in 1946, should enter a calmer period, with supplies trailing behind demand by about 10 per cent. in copper, 20 per cent. in tin, and 25 per cent. in lead. Aluminium is to remain in short supply.

*Institute of British Foundrymen*

# Desulphurisation and Dephosphorisation of Molten Cupola Iron and Pig-Iron in Basic-lined Ladles

## *Report by Sub-Committee T.S.10*

### Constitution of the Sub-Committee

The Sub-Committee was appointed by the Technical Council on September 6, 1944, following the dissolution of the Melting Furnaces Sub-Committee, which had initiated the present work on this subject. The Sub-Committee is composed as follows:—

Mr. L. W. Bolton, John Gardom & Company, Chairman.
Mr. N. L. Evans, Imperial Chemical Industries, Limited.
Mr. V. C. Faulkner, Editor, "The Foundry Trade Journal."
Mr. T. W. Howie, United Steel Companies, Limited.
Dr. A. H. Jay, United Steel Companies, Limited.
Mr. E. Morgan, Stanton Ironworks Company, Limited.
Mr. P. Murray, formerly of the Refractory Brick Company of England, Limited.
Mr. E. S. Renshaw, Ford Motor Company, Limited.
Mr. F. L. Robertson, John Summers & Sons, Limited.
Mr S. Spray, Stanton Ironworks Company, Limited.
Mr. R. Gould and Mr. C. Badcock served as members of the Sub-Committee under the J. W. Gardom Student Scheme.
Mr. J. Bolton, assistant secretary of the Institute, was Secretary to the Sub-Committee.

### Summary

*Desulphurisation.*—Using basic-lined ladles and the newly developed technique of double pouring, it is possible to reduce an initial sulphur content of 0.20 per cent. down to 0.045 per cent. A sulphur reduction of 75 to 80 per cent. can be obtained consistently. These results have been obtained with metal handled in batches of 5 tons. The Sub-Committee believes that there need be no limit to the size of batches of metal so treated.

*Dephosphorisation.*—In investigating the desulphurisation of low silicon cast iron of the type produced from a cupola when melting 100 per cent. steel scrap, it was found that treatment with soda ash removed an appreciable amount of phosphorus. Attempts have been made to increase the efficiency of phosphorus removal by the use of an oxidising agent with the sodium carbonate. In a full-scale commercial trial, a low silicon cupola melted metal had its phosphorus content reduced from 0.045 per cent. down to 0.036 per cent., a reduction of 20 per cent. The temperature loss in carrying out this treatment is not appreciably greater than in normal desulphurisation and the metal can afterwards be used successfully for steel-making by the converter process.

### Introduction

The main work of Sub-Committee T.S.10 has been to examine the possibilities of obtaining desulphurisation and dephosphorisation in basic-lined cupolas, but its terms of reference included also the study of ladle treatment for the removal of sulphur and phosphorus. This report summarises recent experience with the desulphurisation of molten metal in the ladle using soda ash. Experimental work on ladle treatment to obtain dephosphorisation is also described.

### The Need for Desulphurisation

In the production of grey-iron castings, sulphur can usually be kept within suitable limits in cupola-melted metal by the selection of the raw materials used.

Sulphur removal after melting is necessary in special cases, for example:—

(1) The production of some types of castings where the sulphur content must conform to a low specification.

(2) The production of castings where high proportions of poor quality scrap or coke of abnormally high sulphur content are used.

(3) Steel-making by the acid converter process in which an increase of sulphur occurs during cupola melting and by concentration in the converter.

(4) The production of pig-iron.

Regarding (4), most of the refined iron made from the cupola is desulphurised, the treatment being carried out in the receiving ladles before casting into pigs. The majority of ordinary blast-furnace pig-irons used in the foundry are not given this treatment, but there are certain cases in which it is necessary. Instances of this are basic iron for steel-making which has a high initial sulphur content and irons of specified composition for which the smelting technique results in high sulphur.

### The Desulphurisation of Cupola Metal

The success of the sodium carbonate process for the desulphurisation of grey cast iron depends on the inti-

## *Basic Cupolas*

mate mixture of a molten sodium carbonate slag with the metal being treated. Sodium carbonate has a melting point of 851 deg. C., so that when the required dose is put into the bottom of the ladle and the molten iron is tapped on to it, the sodium carbonate melts very rapidly and at the same time there is an evolution of carbon dioxide. This causes an active boil of the contents of the ladle, which, together with the stirring action of the stream of metal running into the ladle, results in a mixing of slag and metal.

The proportion of sodium carbonate necessary varies according to the type of metal being treated, but is usually from 20 to 45 lb. per ton of metal. In grey-iron foundries 20 to 25 lb. is usual, and in Tropenas steel foundries 30 to 45 lb. per ton is commonly used.

The desulphurising reaction takes place almost instantaneously and, when the stream of metal ceases to run into the ladle, the slag comes to the surface fairly rapidly. In normal cases the de-slagging of the ladle may be commenced almost immediately after it has been filled. This operation takes a minute or two even with a small ladle, and during that time the last traces of slag have ample opportunity of rising to the surface. The easiest method of de-slagging is to use a skimmer with a hardwood blade. With the assistance of this and by tilting the ladle, most of the slag can be run off in the fluid condition. The last traces are thickened by the addition of a small quantity of limestone chippings (approximately $\frac{1}{4}$ in. to $\frac{1}{16}$ in. particle size), which is scattered over the surface of the metal and is then raked together, bringing the slag with it and converting it into a dry clinker which can be readily removed. Slag should, of course, be raked off over the lip, opposite to the one which will be used for pouring the metal.

The most important precaution to observe in carrying out this process is to prevent the admixture of silica or siliceous slag with the soda slag. With this end in view, great care should be taken to stop the stream of metal from the cupola before any slag escapes, and the cupola spout should be kept clean and in good repair. In some works it is found convenient to use dry sand in the place of limestone for thickening the last traces of soda slag. Sand should, however, on no account be added to the ladle if any appreciable quantity of soda slag be present.

The temperature of the metal is of some importance. At temperatures higher than 1,500 deg. C., dissociation and volatilisation of sodium carbonate takes place very rapidly and the reaction is inclined to be violent. Metal of this temperature is rarely obtained from either a cupola or a blast furnace, so that difficulty in this connection is unlikely to arise. It has been observed that, provided the metal is sufficiently hot to remain fluid, the desulphurising reaction is more efficient the lower the temperature of the metal

### Obtaining Increased Efficiency of Desulphurisation

During the past few years, a demand has arisen for an increased degree of desulphurisation of cast iron. Due to the pre-war abundance and cheapness of steel scrap, there was a tendency to use high percentages of steel scrap in the cupola to produce metal for Tropenas converters and for refined pig-iron. During the war, this tendency became more pronounced owing to shortage of pig-iron. The higher coke ratios used for melting this type of charge, together with the necessity of employing coke of inferior quality, have resulted in manufacturers being faced with the problem of desulphurising cupola metal of 0.15 to 0.20 per cent. sulphur content down to values of the order of 0.03 per cent. In order to meet this demand for an improved degree of desulphurisation, the use of basic-lined ladles has been investigated.

Three main types of basic linings have been used:—

(1) *Tar-bonded graded dolomite linings.*—Dolomite, occurring abundantly in Great Britain, is the double carbonate of calcium and magnesium. The quarried rock is calcined in shaft kilns at a temperature of 1,600 deg. C., approximately. However strongly the dolomite may be burned, the resultant basic material slakes after some days, due to hydration of the lime produced on calcination. Its use is, therefore, confined mainly to the linings of open-hearth steel furnaces. For the installation of monolithic linings, the calcined dolomite is crushed, graded, mixed with approximately 6 per cent. of dehydrated tar and stored in suitable containers.

(2) *Monolithic stabilised dolomite linings.*—Calcined dolomite can be stabilised permanently against hydration by chemical combination with siliceous materials at high temperatures, to form essentially tricalcium silicate and magnesia. The stable clinker is produced by the addition of finely ground serpentine to the finely ground raw dolomite; water is added during the mixing and grinding process, and the slurry is fed into a rotary kiln and fired at a temperature exceeding 1,600 deg. C. The choice of serpentine has two advantages in that stabilisation is effected by silica which, by virtue of its low molecular weight and its ability to form tricalcium silicate, is capable of combining with more lime, weight for weight, than any of the other suitable oxides and, secondly, in that the magnesia contributed by the serpentine increases the MgO content of the clinker, thus raising its refractoriness and slag resistance. The clinker issuing from the rotary kiln is crushed and suitably graded. In the installation of basic ladle linings, the graded material is mixed with 7 per cent. of water and rammed pneumatically behind formers. The material gives an excellent hydraulic set, since it is rich in tricalcium silicate. For this reason, however, the material should not be allowed to stand after tempering with water and mixing should proceed at the same rate as ramming.

(3) *Fired stabilised dolomite brick linings.*—In the production of stabilised dolomite bricks, the crushed, screened and graded material is mixed with 4 to 5 per cent. of water in a counter current mixer. A weighed quantity of the mixture is then placed in the boxes of a brickmaking machine in which the bricks are pressed three at a time at about 7 tons to the sq. in. The

cupola melted metal had its phosphorus content reduced desulphurisation of grey cast iron depends on the inti-



bricks are then transferred to stoves, where they are carefully dried in a stream of clean air which has been heated by passing through one of the cooling kilns. After drying, the bricks are stacked in producer-gas fired kilns and burned for six days, giving a 48-hr. soaking period at 1,450 deg C. Typical properties of the fired stabilised dolomite bricks are given in Table I. It will be noted that the thermal shock resistance is low, and hence the bricks are not generally recommended for use in exposed positions. For this reason, the earlier trials were carried out with monolithic linings of either tar-bonded dolomite or stabilised dolomite, mixed with water.

TABLE I.—*Typical Properties of Fired Stabilised Dolomite Brick.*

1. *Chemical analysis* (per cent.).

| $SiO_2$ | $Fe_2O_3$ | $Al_2O_3$ | CaO | MgO |
|---|---|---|---|---|
| 15.1 | 3.2 | 2.0 | 39.1 | 40.6 |

2. *Porosity*, 20 per cent.
3. *Bulk density*, 2.71 gm./ml. (169 lb./cub. ft.).
4. *Specific gravity*, 3.39.
5. *Cold crushing strength* (tested on 4½-in. by 3-in. face), over 8,000 lb./sq. in.
6. *Permeability to air*, 0·10 c.g.s. units.
7. *Thermal expansion* (20 to 1,000 deg. C.), 1.3 per cent.
8. *Thermal conductivity*, 15 b.t.u. per sq. ft./in./hr./deg. F. (Mean temperature, 700 deg. C.).
9. *After contraction* (2 hours at 1,500 deg. C.), 0.4 per cent.
10. *Refractoriness under load* (25 lb./sq. in. maintained 2 hours at 1,500 deg. C.), 5.0 per cent. subsidence.
11. *Refractoriness under load* (50 lb./sq. in. rising temperature)
    - Initial softening .. .. .. 1,460 deg. C.
    - Rapid softening .. .. 1,510 deg. C.
    - Failure .. .. .. .. 1,650 deg. C.
12. *Spalling resistance index*, 2 cycles.

## INDUSTRIAL RESULTS

Results obtained with linings of these materials may be summarised as follow:—

### Firm A. Manufacturing Tropenas Steel Castings

The cupola metal is desulphurised in ladles of 3½ tons capacity, using 30 lb. of sodium carbonate per tin of metal. Originally, rammed linings of "compo" plus 10 per cent. plumbago were used, and the final sulphur content of the steel made from treated metal was 0.035 to 0.050 per cent., representing a sulphur removal of approximately 50 per cent. from a 0.09 per cent. sulphur content. It was decided to try a rammed tar/dolomite lining. After installation, the lining was heated up with a coke fire until the major part of the tar had been burned out. The lining was also kept hot during shut-down periods by inverting the ladle over a gas burner

Regular sulphur values of 0.02 to 0.03 per cent. were obtained with 30 lb. of sodium carbonate per ton, giving a sulphur removal of 66 to 77 per cent. with a lining life of 96 heats. No slag attack could be detected throughout the run and the lining was discarded because it wore thin at the lip where the molten metal was poured. The bottom required attention after 50 heats and the area which had been eroded by the cupola stream was replaced.

The use of this type of lining has now become standard practice at this firm and, with improvements in technique of ramming and burning in the lining, the life has been increased and the average is now 130 heats. This is considered satisfactory as, due to the slaking tendency of calcined dolomite mentioned previously, the lining is not patched. It must be emphasised that this firm is in the fortunate position of being able to obtain supplies of freshly delivered dolomite from their adjacent electric steel plant.

In an effort to overcome the necessity of keeping these linings hot during shut-down periods, a rammed water-bonded stabilised dolomite lining was installed. In this instance, a small amount of clay was mixed with the stabilised dolomite in order to increase the medium temperature strength of the material. A life of the same order as that of the tar/dolomite linings was obtained, but the sulphur removal was lower, the final sulphur content being 0.03 to 0.04 per cent. It is difficult to see the reason for this lower efficiency, as the rate of erosion with both types of lining is very small, only 1/50 in. per heat, and the silicon content of the slag resulting from the erosion of the clay-bonded lining is only 1 to 2 per cent. more than with the straight material.

### Firm B. Manufacturing Tropenas Steel Castings

The ladles, which had a capacity of 4 tons, were originally rammed with a mixture of 80 per cent. ganister and 20 per cent. plumbago and patched with ganister. The efficiency of desulphurisation obtained with ganister linings is illustrated by the figures shown in Table II, obtained on samples taken during the same period as the basic lining trials.

TABLE II.—*Typical Desulphurising Results Obtained with Ganister-lined Ladles as Compared with those Obtainable from Basic Linings (Tables III and IV).*

| | Final sulphur contents, per cent. | |
|---|---|---|
| | 1. | 2. |
| Average of 20 blows .. .. | 0.047 | 0.044 |
| Highest value .. .. .. | 0.054 | 0.052 |
| Lowest value .. .. .. | 0.037 | 0.039 |

Three types of basic linings were given trials:—

(1) *Rammed, graded stabilised dolomite.*—This was mixed with 6 to 7 per cent. of water and rammed round a former. The lining was dried slowly, first with wood, then with partly burned coke, and finally the ladle was inverted and heated over a gas flame prior to use. One day's use, during which 70 tons of cupola metal were treated, caused very little damage to the lining. An improvement was effected in desulphurisation, not only was the average figure lower, but there was much greater regularity (see Table III).

TABLE III.—*Typical Desulphurising Results Obtained in Rammed, Graded, Stabilised, Dolomite Ladle Linings.*

| | Final sulphur contents, per cent. | | | |
|---|---|---|---|---|
| | 1. | 2. | 3. | 4. |
| Average of 20 blows.. | 0.035 | 0.036 | 0.036 | 0.036 |
| Highest value .. | 0.041 | 0.041 | 0.042 | 0.040 |
| Lowest value .. | 0.030 | 0.032 | 0.030 | 0.032 |

## *Basic Cupolas*

This lining was used successively for three days and no patching was necessary until after the fourth day. No undercutting of the lining took place near the bottom of the ladle, as is the case with ganister linings, but the lining became barrel shaped and it appeared that attrition by the metal, and not attack by soda slag, was responsible for the lining wear. An attempt was made to patch the lining, but the patching material began to come away from the lining after three or four heats of metal had been put through the ladle. This unsatisfactory behaviour of the patching material was attributed to the failure to chip away the glaze from the lining before patching.

(2) *Unfired, stabilised dolomite bricks.*—The ladle lining consisted of a 4½-in. thickness of brick with a backing of 2 in. of rammed stabilised dolomite. This lining behaved well for 100 heats of metal, all treated with sodium carbonate. After this period, patching was necessary and the lining could not be said to be an improvement over the first rammed lining. The degree of desulphurisation was similar to that obtained with the rammed stabilised dolomite lining.

(3) *Fired, stabilised dolomite bricks.*—Side arch bricks were used; thin joints were obtained by the use of plasticised stabilised dolomite jointing cement, and, after careful drying, the ladle was put into service. The life was very much improved and the fired bricks resisted the attrition of the metal very well, spalling giving practically no trouble. On the first day that the lining was in use, it appeared to be spalling a little, but this did not continue once the bricks had become impregnated with soda slag. Table IV shows the desulphurisation results obtained on five successive days. 30 to 35 lb.

TABLE IV.—*Typical Desulphurising Results Obtained in Fired Stabilised Dolomite Brick-lined Ladles.*

| | Final sulphur contents, per cent. | | | | |
|---|---|---|---|---|---|
| | 1. | 2. | 3. | 4. | 5. |
| Average of 20 blows.. | 0.035 | 0.035 | 0.033 | 0.032 | 0.032 |
| Highest value .. | 0.043 | 0.039 | 0.043 | 0.038 | 0.040 |
| Lowest value .. | 0.030 | 0.030 | 0.030 | 0.028 | 0.026 |

of sodium carbonate is used per ton of metal and the final sulphur content figures represent a reduction of 70 per cent. The patching cement had also been improved, special attention having been paid to the plasticity, and it was found that the material lasted a full day's operation. The use of fired stabilised dolomite bricks has now become standard practice at this plant. Patching of the lining commences after 150 heats, approximately, and the ultimate life of the lining is of the order of 500 heats (2,000 tons of metal treated).

### Firm C. Manufacturing Tropenas Steel Castings

The ladles used at this plant were of 45-cwt. capacity and normally lined with firebrick. The linings were patched extensively with ganister and were renewed completely after 1,000 heats. The cupola metal had a sulphur content of 0.12 to 0.15 per cent., and difficulty was experienced when desulphurising in ganister linings, in reducing the sulphur content to 0.06 per cent., the upper specification limit. In fact, values of 0.09 per cent. sulphur had been obtained after desulphurisation and the average reduction on this practice was 40 per cent.

A fired stabilised dolomite brick lining was, therefore, installed for the desulphurisation of cupola metal prior to the manufacture of special castings, and has been used, on an average one day, 10 heats per week. A total of 73 heats has been obtained before patching was necessary, chiefly on the bottom of the ladle.

Desulphurisation was improved; treatment with sodium carbonate at the rate of 37 lb. per ton, giving values of 0.04 to 0.05 per cent. sulphur, representing a reduction of 60 to 70 per cent.

### Firm D

The conditions at this plant are very similar to those at Firm C. Fired stabilised dolomite brick linings have been adopted as standard practice in the desulphurising ladle. The sulphur reduction is 60 to 65 per cent. in the basic linings, as against 40 to 45 per cent. with siliceous linings.

### Firm E. Manufacturing Tropenas Steel Castings

A double pouring method of desulphurisation was in use at this plant. The cupolas, which are rated at 20 tons per hour, are fitted with receivers of 5-ton capacity, mounted on trunnions. At the time of these experiments, the cupola charge was 100 per cent. steel scrap, and the following was a typical analysis of the metal at the spout:—C, 2.95; Si, 0.15; Mn, 0.36; S, 0.20, and P, 0.069 per cent.

The double pouring method of desulphurisation is carried out as follows:—Four to five tons of metal from the cupola is tapped into the receiver, with the simultaneous feeding of 140 to 175 lb. of granular sodium carbonate (35 lb. per ton) during the tapping of the first 2 tons of metal. Metal and slag are then poured from the receiver into a firebrick-lined transfer ladle, from which the slag is raked off. No thickener is added. The average reaction times are as follow: Tapping from cupola, 4 min.; pouring into transfer ladle, 2 min.; raking off slag, 2 min.

Under these conditions, even with best quality firebricks, severe wear was experienced at the receiver slag line. This difficulty was further aggravated by the fact that, at the height of the war, it became necessary to operate the cupolas on a double-shift system with a total of 300 tons of metal melted, and it was frequently necessary to carry out repairs to the receiver lining during the run. In fact, on occasions, the receiver had to be changed.

It was decided, therefore, to instal a lining of 9-in. by 4½-in. by 3/2½-in. fire stabilised dolomite side arch bricks in the cupola receiver. Approximately 1 in. of the basic lining was lost by spalling during the first few heats, but subsequently the lining became seasoned with soda slag and the rate of wear was very small and uniform over the lining surface. About 1,800 tons of

cupola metal were desulphurised in this lining, the thickness being 1 in. when scrapped.

As a result of this experiment, the fired stabilised dolomite brick lining was adopted as standard for the cupola receivers. Spalling has been minimised by paying attention to:—(1) Rate and degree of preheating—the lining should be as hot as possible when brought into use; and (2) method of addition of sodium carbonate—during the first few heats it is preferable to add the sodium carbonate to the bottom of the ladle so that the lining becomes impregnated by the rising soda slag.

TABLE V.—*Typical Desulphurising Results Obtained by Double-ladle Treatment in a Fired, Stabilised Dolomite Brick-lined Receiver and Fire-brick-lined Ladle.*

| Ladle No. | Sulphur contents, per cent. | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1. | 2. | 3. | 4. | 5. | 6. | 7. | Average |
| A | 0.187 | 0.187 | 0.235 | 0.235 | 0.206 | 0.178 | 0.173 | 0.200 |
| B | 0.059 | 0.048 | 0.077 | 0.058 | 0.086 | 0.048 | 0.048 | 0.060 |
| C | 0.043 | 0.043 | 0.043 | 0.048 | 0.062 | 0.053 | 0.038 | 0.043 |

A. Metal from cupola. B. After first stage of desulphurisation in basic-lined receiver. C. After pouring metal and slag into the firebrick-lined transfer ladle.

The figures in Table V show the degree of desulphurisation after each stage from seven consecutive ladles. It will be seen from the average figures that 70 per cent. of the sulphur is removed in the basic receiver with a further reduction in the transfer ladle, giving an overall reduction of 78.5 per cent.

### Desulphurisation of Pig-iron

The results obtained in the work described above show that pig-iron can be supplied to open-hearth furnaces with much lower sulphur contents than at present, and hence the difficulties experienced in removing sulphur during the refining of low carbon steels may be considerably reduced. The results obtained at Firm E establish that iron of original sulphur content 0.200 per cent. can be desulphurised to values of 0.03 to 0.04 per cent., and, when it is realised that the sulphur specification for some low carbon steels is 0.030 per cent. maximum, it will be seen that this process is of the utmost importance to basic steelmakers. The basic pig-iron supplied, frequently has a sulphur content of the order of 0.08 per cent. When metal is treated with sodium carbonate, some of its silicon is removed. This loss is not very appreciable and, with original silicon contents in the range 1.0 to 1.5 per cent., is usually of the order of 0.10 to 0.15 per cent. It should, however, be noted that, other things being equal, the more effective the desulphurisation treatment, the greater is the tendency for silicon to be lost. This tendency is important from the open-hearth angle. It has been stated that the use of the present materials available results in a slag volume of 20 to 30 per cent. of the weight of steel, in the manufacture of low carbon rimming steels by the cold pig process. The removal of silicon from the basic pig-iron as a result of treatment in the basic-lined ladle desulphurisation process would thus tend to reduce slag volume and results in improved heat transfer, and hence increased production in the open-hearth furnace.

Accordingly, small-scale experiments have been carried out along similar lines to those at Firm E. The double-pouring method was used with two ladles lined with fired stabilised dolomite bricks. After treatment with soda ash at the rate of 30 lb. per ton in the first ladle, the soda slag was skimmed off, the metal transferred to the second ladle, and a further 30 lb. of soda ash per ton of metal added. After the second soda slag had been skimmed off, the metal was cast into pigs. The metal was produced by melting 100 per cent. steel scrap in an acid-lined cupola. Typical results obtained are shown in Table VI, each figure being the average of twelve consecutive taps.

TABLE VI.—*Typical Desulphurisation Results Obtained by Double Ladle Treatment. Two Fired Stabilised Dolomite Brick-lined Ladles. (Each Figure is the Average of 12 Taps.)*

| Date .. .. .. | February 22. | March 5. | March 15. |
|---|---|---|---|
| Sulphur, per cent.— | | | |
| A .. .. .. .. | 0.159 | 0.133 | 0.114 |
| B .. .. .. .. | 0.058 | 0.049 | 0.045 |
| C .. .. .. .. | 0.028 | 0.025 | 0.022 |
| Silicon, per cent.— | | | |
| A .. .. .. .. | 0.18 | 0.29 | 0.15 |
| B .. .. .. .. | 0.11 | 0.19 | 0.05 |
| C .. .. .. .. | 0.06 | 0.11 | 0.04 |

A—Metal in cupola spout. B—Metal after first soda-ash treatment C—Metal after second soda-ash treatment.

These figures again demonstrate the increased desulphurisation efficiency obtained with this method, and the silicon loss is of interest from the point of view of reduced slag volume. In order that this process may be applied to the treatment of basic iron at the blast furnace, it will, of course, be necessary to produce a basic-lined ladle of suitable size, but the experience now available on ladles of up to 5 tons capacity will serve as a useful basis for further work.

### The Preparation and Maintenance of Basic Ladle Linings

The preparation and maintenance of basic linings has been referred to briefly above. The details of the installation, drying and maintenance of the receiving ladle may be illustrated by reference to the practice at Firm E. One inch of stabilised dolomite patching cement at jointing consistency is first placed on the base of the ladle, followed by a course of stabilised dolomite bricks laid flat, *i.e.*, 3 in. thick. The first three courses of side arch stabilised dolomite bricks for the ladle walls are then laid, after which a further course of stabilised dolomite bricks are laid on edge (*i.e.* 4½ in. thick) inside the wall, giving a total brickwork thickness of 7½ in. on the bottom of the ladles.

The walls consist of a lining of 9 in. by 4 in. by 3/2½ in. side arch bricks (*i.e.*, 4½ in. thick), behind which approximately 1 in. of stabilised dolomite patching cement at jointing consistency is tamped. The brick lining is carried slightly above the ladle shell and the

## *Basic Cupolas*

top edge of the shell and lining are daubed to prevent damage from splashing metal. The bricks are set very carefully with the minimum of jointing, stabilised dolomite jointing cement being used throughout. The whole of the lining is finally coated with a wash of the stabilised dolomite jointing cement.

For drying, a small gas flame is used, the burner being a piece of 1-in. steam pipe with slots along its length. The gas is adjusted to prevent flame impingement on the ladle walls. After thorough drying by gas, the ladle is half filled with coal, which is ignited and left to burn out. The temperature is raised gradually during the drying and heating operations and no interruption is allowed to take place, the ladle being as hot as possible when brought into use.

Patching usually begins after 100 heats, the technique being as follows:—After the day's run (300 tons of metal tapped), the ladle is allowed to cool off. The surface is then cleaned, after which a thin layer of stabilised dolomite patching cement at daubing consistency is applied. The patch is then dried slowly by means of a gas pipe in a similar manner to the normal ganister linings. Towards the end of the lining life, fired stabilised dolomite splits may be inserted in the daubing. This has been found to increase the life of the lining.

Regarding lining life, experience at Firm B and Firm E has shown that 500 heats, equivalent to approximately 2,000 tons of metal treated, is the average life with receivers of 4 to 5 ton capacity. Patching commences after 100 to 150 heats and, during the test runs described, the consumption of stabilised dolomite patching cement was one-third to one-half of the normal consumption of ganister. At Firm B, the total cost of the basic materials, *i.e.*, stabilised dolomite bricks, jointing cement and patching material is approximately 6d. per ton of metal treated.

### Factors Affecting the Efficiency of Desulphurisation

Desulphurisation of iron by means of sodium carbonate should be regarded as a chemical operation subject to the normal laws of chemistry, that is to say, if the conditions are kept constant, it is possible to repeat results with complete regularity. It is a matter of experience over a considerable period of time that this can be done if sufficient care is taken, and it is considered that the results obtained during the war period have disposed finally of the criticism that sodium carbonate does not give consistent results.

The following variables should be taken into consideration:—(1) Proportion of sodium carbonate used; (2) composition of the metal; (3) temperature of the metal, and (4) general conditions of carrying out the process, such as the composition and condition of the ladle lining, the amount of cupola slag allowed to get into the ladle, etc.

Of these variables, the two of greatest practical importance are the composition of the ladle lining, and the amount of siliceous slag present. Silica mixed with sodium carbonate slag retards and may even reverse the desulphurising reaction. The normal reaction on which the process depends results in the sulphur in the manganese sulphide and iron sulphide originally present in the metal being converted to sodium sulphide which is slagged off. The following equation shows how this may be reversed.

$$Na_2S + SiO_2 + \begin{matrix} Mn\,O \\ FeO \end{matrix} \longrightarrow Na_2SiO_3 + \begin{matrix} MnS \\ FeS \end{matrix}$$

It is therefore desirable to use a ladle lining of which silica is not a major constituent and which has sufficient mechanical strength to resist rapid abrasion. The service trials described show that the best results are obtained with a lining of calcined dolomite mixed with tar and rammed around a former. Such a lining, however, has the disadvantage that calcined dolomite hydrates readily and in the hydrated condition it has a negligible mechanical strength. A ladle which is in more or less continuous use is satisfactory, and such linings can be used in foundries where the ladles are never allowed to stand cold or outside a building for long periods. When it is not possible to fulfil these conditions, however, the next best type of lining is stabilised dolomite brick, the bricks being bonded with cement of similar composition and the joints kept as thin as possible.

It should be emphasised, however, that care in the selection of a ladle lining is completely vitiated if cupola slag and sand are allowed to run into it. It has been shown conclusively* that the presence of even a small percentage of silica in a basic lining impairs the efficiency of desulphurisation to a marked degree.

It is quite possible to get a sufficiently satisfactory degree of desulphurisation for many purposes with the use of ordinary firebrick-lined ladles or even ladles with loam. With the latter, the first batch of metal treated in a new lining may not be desulphurised to the same extent as subsequent batches, but once the ladle has been used with soda slag and the pores of the refractory have been filled and glazed over, it is possible to remove sulphur to the extent of approximately 50 per cent. of the initial content, provided the precautions referred to above, as regards keeping slag out of the ladle, are strictly adhered to.

It is not easy to relate metal composition to the degree of desulphurisation with any degree of certainty. Provided the conditions referred to above are complied with, a high degree of desulphurisation can be obtained with both low silicon and high silicon metal. It is thought that the essential conditions are:—(*a*) To have a metal temperature low enough to avoid an excessively violent reaction and rapid volatilisation of the carbonate, and (*b*) sufficient fluidity for the metal and slag to become thoroughly mixed together in the ladle.

The Committee is convinced that variations in the degree of desulphurisation are due not to any fundamental unreliability of the sodium carbonate process, but to lack of care and attention in controlling the variables referred to above.

* Journal of the Iron and Steel Institute, 1944, No. 1, page 183 P.

## Conclusions

(1) Service trials have demonstrated that a decidedly improved degree of desulphurisation can be obtained by carrying out the process in basic-lined ladles.

(2) Tar-dolomite ladles give the highest desulphurising efficiency, but the tendency of calcined dolomite to "perish" during shut-down periods prevents the general application of this type of lining.

(3) Fired stabilised dolomite brick linings have been proved to give excellent results, an average sulphur reduction of 60 to 65 per cent. being obtained from a single treatment as compared with approximately 50 per cent. in an acid-lined ladle.

(4) By using the double-pouring method, sulphur removal can be increased to 75 to 80 per cent.

average amount of phosphorus removed amounts to 16 per cent. of the original phosphorus content. The phosphorus removed from the metal is accounted for by the amount of $P_2O_5$ present in the soda slag. The initial silicon content of the metal was low and the bulk of the silicon present was removed by the treatment.

The presence of $P_2O_5$ in soda slags was later confirmed at another works using a similar procedure, except that the metal was treated in batches of approximately 30 cwt. and both ladles were lined with stabilised dolomite bricks. Melting charges, consisting of 100 per cent. steel scrap desulphurising slags containing up to 2.0 per cent. $P_2O_5$ were produced. With a pig-iron charge containing approximately 1 per cent. of

TABLE VII.—*Dephosphorisation of Cupola Metal by Sodium Carbonate Treatment Using Double Ladling (one Basic, one Acid-lined).*

| Ladle No. | 1. | 2. | 3. | 4. | 5. | 6. | 7. | Average. |
|---|---|---|---|---|---|---|---|---|
| Carbon, per cent.— | | | | | | | | |
| A | 2.92 | 3.00 | 2.92 | 2.83 | 3.03 | 2.98 | 2.95 | 2.95 |
| B | 2.92 | 2.95 | 2.73 | 2.84 | 2.88 | 2.78 | 2.78 | 2.73 |
| C | 2.86 | 2.89 | 2.73 | 2.73 | 2.68 | 2.73 | 2.73 | 2.76 |
| Silicon, per cent.— | | | | | | | | |
| A | 0.17 | 0.16 | 0.15 | 0.12 | 0.13 | 0.19 | 0.10 | 0.15 |
| B | 0.03 | 0.06 | 0.08 | 0.04 | 0.06 | 0.04 | 0.03 | 0.05 |
| C | 0.03 | 0.02 | 0.05 | 0.04 | 0.03 | 0.03 | 0.04 | 0.035 |
| Manganese, per cent.— | | | | | | | | |
| A | 0.39 | 0.31 | 0.33 | 0.32 | 0.30 | 0.43 | 0.40 | 0.36 |
| B | 0.30 | 0.27 | 0.25 | 0.28 | 0.28 | 0.37 | 0.37 | 0.30 |
| C | 0.28 | 0.25 | 0.22 | 0.25 | 0.23 | 0.34 | 0.28 | 0.26 |
| Phosphorus, per cent.— | | | | | | | | |
| A | 0.070 | 0.068 | 0.065 | 0.066 | 0.071 | 0.073 | 0.072 | 0.069 |
| B | 0.062 | 0.064 | 0.060 | 0.053 | 0.068 | 0.065 | 0.065 | 0.063 |
| C | 0.056 | 0.057 | 0.058 | 0.054 | 0.061 | 0.062 | 0.060 | 0.058 |

A—Metal in cupola spout. B—After first stage soda-ash treatment. C—After second stage soda-ash treatment.

TABLE VIII.—*Analyses of Slags Produced during Dephosphorisation of Cupola Metal shown in Table VII.*

| Ladles. | Analysis, per cent. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $SiO_2$ | $Al_2O_3$ | $P_2O_5$ | FeO | MnO | CaO | MgO | $SO_3$ | S | Alkalies |
| 1—3 | 19.4 | 5.0 | 2.9 | 5.4 | 2.8 | Trace | Trace | 2.9 | 4.2 | 56.4 |
| 4—7 | 16.1 | 5.0 | 2.9 | 4.9 | 4.1 | Trace | Trace | 3.8 | 4.3 | 58.9 |

## Dephosphorisation

The original work which indicated that some measure of dephosphorisation could be obtained by treatment of cupola metal with soda ash in amounts similar to those normally used for desulphurising, was carried out on metal produced from a 100 per cent. steel charge. The metal was tapped into a receiving ladle lined with stabilised dolomite bricks, in quantities of 4 to 5 tons, and treated with granular sodium carbonate at a rate of 35 lb. per ton. The metal and slag were then poured from this ladle into a firebrick-lined ladle from which the slag was raked off, no thickener being added.

The composition of samples taken from seven consecutive taps, before and after each stage of the treatment, is shown in Table VII. Slag samples were taken from each ladle. Averages were made of ladles 1 to 3 and 4 to 7 for chemical analysis and results obtained are shown in Table VIII. It will be noted that the phosphorus, slags with $P_2O_5$ content of over 6 per cent. were obtained. It was decided that a higher efficiency of phosphorus removal might be secured if a slag of higher iron oxide content than the normal desulphurising slag were produced. An attempt to produce this condition by playing a jet of oxygen on to the stream of metal from the cupola spout was not successful. A number of laboratory trials were therefore made, and the following indicates the type of results obtained.

## Laboratory Experiments on the Dephosphorisation of Cast Iron

Ten pounds (160 oz.) of low silicon (0.12 per cent.) iron, with an addition of 3¼ oz. of ferro-phosphorus (25 per cent. P), was melted in a magnesia crucible. The metal was sampled as soon as it was molten (metal sample 1) and 6.4 oz. of a mixture consisting of equal weights of sodium carbonate and mill scale was added,

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over a period of about 10 min. This first melted, then formed a pasty crust over the melt, and, on stirring, it formed into floating masses of apparently solid clinker. A sample of this was taken at an early stage (slag sample 1), and again 10 min. after the start of the slag addition (slag sample 2), when the metal was also sampled (metal sample 2). A further 4.5 oz. of the slag mixture was then added to the melt over a period of 9 min., after which samples were again taken (slag sample 3 and metal sample 3). The analyses are shown in Table IX, from which it will be seen that an original phosphorus content of 0.49 per cent. was reduced to 0.15 per cent.

A further experiment was carried out to find the extent to which a mixture of sodium carbonate and iron oxide will desiliconise cast iron.

TABLE IX.—*Experimental Dephosphorisation with Sodium Carbonate and Mill Scale of a Low Silicon* (0.12 *per cent.*) *Iron in the Laboratory.*

| | Metal samples | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| | Per cent. | Per cent. | Per cent. |
| T.C. .. | 2.51 | 2.08 | 1.56 |
| Si .. .. | *Trace | Trace | Trace |
| S .. .. | 0.048 | 0.031 | 0.023 |
| P .. .. | 0.47 | 0.24 | 0.15 |
| Mn .. .. | 0.17 | 0.19 | 0.23 |

* Trace = < 0.02 per cent.

| | Slag samples | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| | Per cent. | Per cent. | Per cent. |
| $Na_2O$ .. | 40.50 | 49.28 | 42.02 |
| $SiO_2$ .. .. | 5.42 | 2.82 | 1.90 |
| $P_2O_5$ .. | 24.35 | 28.46 | 26.66 |
| Iron as $Fe_2O_3$ .. | 15.84 | 8.08 | 11.84 |
| CaO .. .. | Not detected | Not detected | Not detected |
| MgO .. | 1.02 | 1.36 | 10.54 |

Ten pounds (160 oz.) of foundry iron was melted in a magnesia crucible, and sampled (metal sample 1), and 6.4 oz. of a mixture containing equal weights of sodium carbonate and mill scale was added over a period of 15 min. The slag formed remained liquid the whole of the time it was on the metal. At first there was a fairly active boil, but after a time this subsided. The slag was sampled, and, when solid, was in the form of a black brittle glass. The metal was again sampled.

The analyses are shown in Table X. An appreciable amount of silicon has been removed from the metal, but—as would be expected—no significant amount of phosphorus. The fluidity of the slag in this experiment is probably due to the presence of more silica than in the slags obtained in the previous experiment (Table IX).

TABLE X.—*Experimental Dephosphorisation of Medium Phosphorus Foundry Iron with Sodium Carbonate and Mill Scale in the Laboratory.*

| | Metal samples | |
|---|---|---|
| | 1 | 2 |
| | Per cent. | Per cent. |
| T.C. .. .. .. | 3.26 | 3.09 |
| Si .. .. .. | 1.35 | 0.79 |
| S .. .. .. | 0.13 | 0.079 |
| P .. .. .. | 0.94 | 0.88 |
| Mn .. .. .. | 0.35 | 0.22 |

It was felt that this experimental work had demonstrated that sodium slags containing iron oxide will remove appreciable amounts of phosphorus from silicon-free iron of medium phosphorus content, and it was decided that information was needed to show whether they would react satisfactorily if the initial phosphorus content of the metal were low, say less than 0.05 per cent. To investigate this, the following experiment was made.

A charge consisting of 10 lb. of low silicon, low phosphorus iron was melted in an induction furnace in a magnesia crucible. When the charge was melted, it was sampled (sample 1) and an addition of 3.2 oz. (2 per cent.) of sodium carbonate/mill scale mixture was made (equal weights of each), and about 4 min. later this was repeated. The metal was then sampled (sample 2). A third addition of the mixture was then made, and the final sample of metal was then taken (sample 3). Attempts were made to sample the slag but those were not successful. In fact, the slag disappeared very rapidly, presumably by absorption in the crucible walls and by volatilisation. The metal samples were analysed, and the results are shown in Table XI.

The pig-iron used for this experiment had the following composition:—T.C, 2.92; Si, 0.12; Mn, 0.23; S, 0.044, and P, 0.054 per cent.

TABLE XI.—*Experimental Dephosphorisation of Low Silicon, Low Phosphorus Iron with Sodium Carbonate and Mill Scale in the Laboratory.*

| | Si | S | P | Mn |
|---|---|---|---|---|
| | Per cent. | Per cent. | Per cent. | Per cent. |
| Sample 1 .. | Trace | 0.048 | 0.031 | 0.11 |
| Sample 2 .. | Trace | 0.032 | 0.022 | 0.115 |
| Sample 3 .. | Trace | 0.033 | 0.021 | 0.14 |

It will be observed that treatment with the sodium carbonate-mill scale slag reduced the phosphorus by about one-third. As a result of the helpful co-operation of Edgar Allen & Company, Limited, Imperial Steel Works, Sheffield, it was possible to carry out a full-scale trial in order to ascertain whether similar results could be obtained in commercial practice. About 3 to 3½ tons of steel were melted in the cupola, and this was treated in two batches as follows:—32 lb. of dense sodium carbonate was put into a basic-lined ladle (tar dolomite) and the cupola was tapped. As soon as metal began to enter the ladle, 32 lb. of mill scale was thrown in, in four paper bags holding about

§ lb. each. The reason for adding the mill scale separately was that there was some doubt as to how violent the reaction might be. Actually, it was not different from the ordinary desulphurisation of iron with sodium carbonate. While this was going on, the metal was sampled at the cupola spout. The weight of iron tapped into the ladle was 32 cwt., and this took 3½ to 4 min. The ladle was tilted and the slag sampled and raked off, the metal being transferred to a Tropenas converter. After de-slagging, the temperature of the metal in the ladle was 1,320 deg. C., measured by an immersion thermocouple.

The procedure was then repeated on another similar batch of metal, and this, after de-slagging, had a temperature slightly over 1,300 deg. C. This metal was added to the first batch in the Tropenas converter and, after the addition of ferro-silicon, was blown to steel. The full analysis of the metal samples taken in the course of the experiment are shown in Table XII. It will be seen that the original phosphorus content of 0.045 per cent. was reduced to 0.036 per cent., a phosphorus reduction of 20 per cent. A noticeable feature of both the above experiments is the reduced efficiency of desulphurisation obtained when iron oxide is present in the sodium slag. This appears to confirm that an oxidising condition inhibits desulphurisation.

TABLE XII.—*Dephosphorisation of Cupola Melted Low Silicon Iron in a Tar-Dolomite Ladle Using Sodium Carbonate and Mill Scale.*

*First Tap of 32 cwt. of metal.*
Samples taken whilst tapping from cupola (per cent.).

| | C | Si | S | P | Mn |
|---|---|---|---|---|---|
| No. 1 .. | 2.94 | 0.28 | 0.086 | 0.043 | 0.27 |
| No. 2 .. | 3.06 | 0.28 | 0.081 | 0.045 | 0.27 |
| No. 3 .. | 3.06 | 0.27 | 0.089 | 0.044 | 0.28 |

Sample taken from ladle after addition of 1 lb. of soda-ash per cwt. of metal and 1 lb. of Hammerscale per cwt. of metal (per cent.).

| | C | Si | S | P | Mn |
|---|---|---|---|---|---|
| No. 4 .. | 3.0 | 0.17 | 0.054 | 0.037 | 0.24 |

*Second Tap of 32 cwt. of metal.*
Samples taken whilst tapping from cupola (per cent.).

| | C | Si | S | P | Mn |
|---|---|---|---|---|---|
| No. 5 .. | 3.09 | 0.26 | 0.082 | 0.045 | 0.30 |
| No. 6 .. | 3.06 | 0.28 | 0.076 | 0.045 | 0.32 |
| No. 7 .. | 3.0 | 0.26 | 0.078 | 0.045 | 0.32 |

Sample taken from ladle with addition of 1 lb. of soda-ash per cwt. of metal and 1 lb. of Hammerscale per cwt. of metal (per cent.).

| | C | Si | S | P | Mn |
|---|---|---|---|---|---|
| No. 8 .. | 3.0 | 0.15 | 0.043 | 0.036 | 0.26 |

### Conclusions

Cupola iron of low silicon (below 0.2 per cent.) content can be appreciably dephosphorised by treatment with sodium carbonate in the amounts normally used for desulphurisation.

The presence of silicon tends to inhibit dephosphorisation. Experimental work has shown that increased dephosphorisation can be obtained by the use of a mixture of iron oxide (mill scale) and sodium carbonate. Silicon removal is increased by this process, but the efficiency of desulphurisation is slightly reduced.

The Sub-Committee considers that the results of the experimental work described in this report are sufficiently promising to justify a continuance of investigational work on these lines. The subjects of rapid dephosphorisation and desiliconisation are of such importance to the steel industry of this country as to warrant full-time investigation by an appropriate research body.

### Acknowledgments

The Sub-Committee wishes to express its thanks to the following persons and companies without whose assistance and co-operation much of the work reported herein would not have been possible:—

Dr. E. Gregory and Mr. Skelton, of Edgar Allen & Company, Limited, Sheffield.

Imperial Chemical Industries, Limited (Alkali Division), Northwich.

The Refractory Brick Company, of England, Limited, Steetley.

The Stanton Ironworks Company, Limited, Nottingham.

John Summers & Company, Limited, Shotton.

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## Training of Engineers

Mr. T. B. Sansom, of Bruce Peebles, Company, Limited, in his lecture to the Scottish Engineering Students' Association in Edinburgh on February 7, stressed the need for organised training arrangements for apprentices and students of engineering. He outlined both the methods that are in use to-day and those that could be put into use providing industrialists would co-operate with the colleges. He also described the qualifications necessary for a successful liaison officer between the industrial concern and the place of study. He discussed at length the merits and disadvantages of the Degree Course in Engineering, finally suggesting a system that would both have the advantages of University training without the disadvantages of not being able to fulfil the conditions of a five year apprenticeship. In conclusion he quoted two examples taken from the training schemes employed by Metropolitan Vickers and A. Reyrolle & Company. This allowed members of the Association to judge the gap that existed between theoretical ideals and practical applications.

# Lancashire Branch Social Evening

The Annual Social Evening of the Lancashire Branch of the Institute of British Foundrymen took place at the Grand Hotel, Manchester, on Saturday, March 15, 1947, the President of the Branch, Mr. W. Brown (Bramhall), presiding. One hundred and twenty members and friends were present and proceedings commenced with a whist drive at which ladies won four prizes and gentlemen three.

After the customary loyal toast had been honoured, Mr. D. Howard Wood (President of the Institute) proposed the toast of the Lancashire Branch. He reminded those present that the Branch was the first to be formed and that the first Conference of the Institute was held in Manchester some 43 years ago. Lancashire was then the leading Branch and it had continued to maintain a pre-eminent position. Mr. W. Brown, the Branch President, responded.

### "The Visitors"

Mr. E. Longden. M.I.Mech.E., Past Branch President, proposed "The Visitors and Guests," and said that the gathering was honoured by the presence of the President of the Institute of British Foundrymen. Mr. Wood was a very popular President and he had always carried out his official duties with great efficiency and zeal. As a foundry engineer he had contributed much to the improvement and mechanisation of foundry operations. They were particularly delighted to have present with them a very distinguished guest, General Sir William Platt, a director of the famous firm, Mather & Platt Ltd. It was said of Sir William that his father, Mr. John Platt, was keenly disappointed because of Sir William's youthful ambition to become a soldier instead of an engineer. Early in 1946, after 40 years' service in the British Army, Sir William returned to the Company to play a part in directing the firm's destiny. The foundry trade was indebted to Mather & Platt Ltd. for their pioneering spirit in developing production on advanced lines, thereby benefiting not merely the Company but eventually the community.

It was with great pleasure also that they welcomed Mr. Tom Makemson, the Secretary of the Institute, who had done so much to develop the technical aspects of the industry, and his efforts in furthering the education of apprentices was well recognised over the past quarter of a century.

After General Sir William Platt, G.B.E., K.C.B., D.S.O., had acknowledged the toast, Mr. S. Brooks, Past Branch President, proposed the toast of Mr. H. Buckley, the Branch Secretary, to whose zealous service they were only too pleased to pay tribute. He had done much to make the proceedings of the evening a complete success.

Mr. H. Buckley responded, and the remainder of the evening was given over to dancing.

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DOUGLAS FRASER & SONS, LIMITED, Arbroath, are to extend their foundry at Stobcross.

# Notes from the Branches

## *Scottish*

The Annual Business Meeting was held in the Royal Technical College, Glasgow, on March 8, Mr. Tom Shanks, Branch President, was in the chair and was accompanied on the platform by Mr. D. Howard Wood, President of the Institute. The attendance of about 150 members constituted a branch record.

Mr. Bell submitted a report on the activities of the session and the financial statement for the year ending December 31, 1946.

The election of officers for 1947-48 was as follows:—*President*, Mr. R. O. Paterson; *Senior Vice-President*, Mr. Wm. Y. Buchanan; *Jun. Vice-President*, Mr. R. S. M. Jeffrey, B.Sc., F.R.I.C., *Members of Council*, Mr. C B. Doig, Mr. Archd. Macnab, and Mr. Wm. Montgomery; *Representative to General Council*, Mr. John Cameron, Jr., Mr. Alex. Marshall, Mr. Tom Shanks, and Mr. R. R. Taylor; *Representative to Technical Committee*, Evan J. R. Mitchell; Hon. Secretary, John Bell.

At the conclusion of the formal business, Mr. Shanks welcomed Mr. Wood to the meeting and thanked him for coming north through such weather.

In reply, Mr. Wood congratulated the Branch on the wonderful attendance and the splendid work done during the Session. It had come as a welcome surprise to see such a large gathering of foundrymen, and was, he said, unmistakable evidence of the enthusiasm and work of the President, Mr. Shanks, and his officers. He assured his audience that he was returning to Birmingham happy in the knowledge that the Scottish Branch was living up to the high standard expected of them.

He took the opportunity to outline the work of the West Midland Advisory Committee on recruitment and training youths in foundry practice, and suggested that it might be possible for the Scottish Branch to work on similar lines appropriate to Scottish conditions.

Mr. D. H. Young thereafter read a paper on "The Production of Some Large Grey Iron Castings for Marine Engineering." This paper will be printed in a later issue of the Journal, but it is worth recording here that all the photographs of the jobs taken in connection with the paper, and all the slides prepared from these photographs were done by Mr. Maxwell Bryce, one of the moulders engaged on the work described by Mr. Young.

The Annual Branch Dinner was held in the Grosvenor Restaurant in the evening, when a record attendance was also reported. Among the guests present were the Rt. Hon. Thomas Johnston, formerly Secretary of State for Scotland, who proposed the toast of the Institute, Mr. D. Howard Wood, Sir James Lithgow, Bt., Dr. Welsh (representing the Lord Provost of Glasgow), and Mr. Festus Moffat, F.S.A.A.

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THE DIRECTORS OF Davidson & Company, Limited, Sirocco Engineering Works, Belfast, held a reception at their London offices, Morris House, Jermyn Street, S.W.1, to mark the acquisition of these new premises.

# Council of Ironfoundry Associations

## Annual Report for 1946*

*MEMBERSHIP*

The National Association of Malleable Ironfounders was re-admitted to membership in March, 1946.

*ACCOUNTS*

With the anticipated increase in activities, the operating expenses of the C.F.A. have increased considerably, and Printing and Stationery and Postage Accounts amply illustrate this fact. It is pleasing to report, however, that General Office Expenses and Sundries show little increase over 1945.

*MEETINGS*

The following meetings have been held by the various Committees and Sub-Committees:—Annual General (1); Costing (3); Council (3); Education (1); Executive & Finance (8); Five Year Plan, Drafting (2); Transport Advisory Panel (2) and Chairmen (1). In addition there have been attendances at Sub-Committee Meetings held at the various Ministries, and attendances by the Secretary at many other National Committees upon which the C.F.A. is represented, such as the F.B.I. Council, Taxation, Statistics, International Trade Policy, Contracts, Traders Co-ordinating Committee on Transport, National Conference on Transport, etc.

### The Industry

The year 1946 covers one of the most difficult periods in the ironfounding industry, having regard to the transition period which the industry was passing through. Labour had only just started to return to the industry in any quantity, and the problem of training labour was only just beginning to yield results towards the end of the year. This is instanced by the incidence of labour increase and tonnage output in the following figures:—

| | | |
|---|---|---|
| *Labour—January* 1, 1946 | | |
| Industrial Workers .. .. .. | 102,482 | |
| Clerical Staff .. .. .. .. | 4,916 | |
| | | 107,398 |
| *December* 7, 1946 | | |
| Industrial Workers .. .. .. | 124,853 | |
| Clerical Staff .. .. .. .. | 5,577 | |
| | | 130,430 |
| Increase during period .. | | 23,032 |

| | | | |
|---|---|---|---|
| *Tonnage Output* | | | |
| January to March .. .. | 511,512 | | |
| April to June .. .. | 623,714 | | |
| July to September .. .. | 632,689 | | |
| October to December .. | 709,498 | Total | 2,478,413 tons. |

The order of production, however, based on the last quarter's figure is 2.8 million tons a year, which is a very creditable achievement, having regard to the labour situation generally and the fact that the annual production figure in 1945 reached its lowest ebb of 1.9 million tons.

It must be remembered that in the highly skilled sections of the industry, the output is very much lower than it was pre-war, due to the shortage of skilled workers and the difficulty of obtaining apprentices, and the output from the semi-skilled workers must have assumed very large proportions in order to overcome the disabilities from the former.

Among other points which require taking into consideration is the make up of the output figures. For instance, castings generally are not of the same weight now as they were some years ago. The tendency is to conserve weight as much as possible, and castings generally are of lighter construction. It is, therefore, difficult to effect comparisons between like and like in this respect. The output achievement is all the more creditable.

During 1946, strong efforts have been made by all concerned to improve the labour situation. When the efforts of ironfounders come to be expressed in statistics in 1947, as a result of the Iron & Steel Board Questionnaire, the extent of their efforts will be generally apparent in the modernisation schemes completed and in progress. The Garrett Committee virtually completed its deliberations in 1946, and its report is awaited early in 1947. Any legal requirement as a result of this report has not deterred farseeing ironfounders from going ahead with their improvement plans and, in spite of Governmental delays due to red tape and the interpretation of Town and Country Planning Acts—alterations, extensions, and new foundries are being persevered with.

### H.M. Government

Two important events took place during the year in the ironfoundry industry of paramount interest to the future of the industry: The first was the submission of the Ironfoundry Report through the Joint Iron Council to the Government, and the second was the statement on Nationalisation by the Ministry of Supply followed by the appointment of the Iron and Steel Board.

The Council of Ironfoundry Associations has always asserted its decided opposition to nationalisation of the industry, and it is convinced that a much more suitable way of bringing about the re-organisation necessary in the Ironfoundry industry is to be found in the liaison which has been established between the industry and the Iron and Steel Board. At the end of 1946, this was only in its initial stages and was

*The period of the Report covers from January 1, 1946, to December 31, 1946.

## *Council of Ironfoundry Associations*

beginning to assume proportions, which will be more manifest in 1947.

### Foundry Labour in 1946

In 1946, one of the most important moves in the labour situation was the lifting of the Essential Works Order which, generally speaking, has not had any deleterious effect on the industry and has succeeded in creating a better situation. It is perfectly true that, at the present time, high wages are being paid to moulders in various parts of the country by way of tempting them from section to section, which is to be deplored, but these conditions are only transitory, and labour itself is not being moved in large numbers as a result of it.

The upgrading agreement completed between the Unions and the Employers' Federations, which provided for upgrading of certain workers, where it has been correctly applied, has been responsible for quite a considerable intake of labour. It is, however, unfortunate that it could not be applied generally.

During 1946 the industry has enjoyed general industrial deferment for its young labour which will be continued where granted, but no fresh deferments for young workers will be granted during 1947, in accordance with the White Paper. Considerable pressure is being exerted on the Government by the Unions and the C.F.A. jointly, to seek amendment of this state of affairs, but no good progress has yet been made.

It is pleasant to record the co-operation which has existed between the C.F.A. and the foundry Trade Unions during the year under review. At one time criticism was levelled at the Unions for their condemnatory actions regarding conditions in the industry, but it is now generally appreciated that employers intend and are doing all they possibly can, at the present time, to improve conditions. It is evident that both sides of the industry are now working hard for the ultimate good of the industry.

### Education

The C.F.A. booklet entitled "The Future for Boys in the Foundry" has had an immense circulation during 1946, and has now passed the stage where it was necessary to seek distribution. Requests for the booklet are coming in from all sources and particularly from new juvenile services, who are immensely interested in it. At one time it proved difficult to find places where the booklet could be sent. Now the position has changed, and demand exceeds supply.

Another important departure in the field of education is the introduction of film strips. When these film strips were first provided as an experiment, in the early part of the year, it was not thought that they would have anything like the success which they have obtained. It has, however, been proved that the use of the film strip is of first class importance either for propagation of the industry or for training purposes.

The general film strips, prepared by the C.F.A., have been used by local associations in talks on ironfounding. Private firms have purchased them complete with lanterns and have made themselves responsible for exhibiting these film strips in their own areas, in order to popularise the industry and the film strip is now being used as a means of teaching classes in ironfounding at Technical Colleges.

There is no limit to the good use to which film strips can be put, and any member firms, who have not yet tried out the film strips, as a means of furthering educational methods, are advised to investigate the possibility, when they will no doubt become fully convinced of its value. Where difficulties are experienced with regard to shortage of film strip lanterns, these can be supplied by the C.F.A.

C.F.A. film strips have been supplied throughout the whole of the country and to many foreign countries, and with the new film strip now being made for the C.F.A. by Educational Publicity, Limited, it is anticipated that it will be possible to send them out in hundreds to all Technical Colleges requiring them.

It is regretted that it has not been possible to re-open the British Foundry School during 1946. This has been due to the fact that it was not practicable to go ahead with the scheme in Birmingham owing to difficulties in agreement between the Birmingham Educational authorities and the Ministry of Education. Difficulties, however, have now been solved, and accommodation has been found at Wolverhampton. The school will re-open definitely in 1947.

### Conference of German Investigation Teams

Early in the year, a Conference was held at St. Pancras Assembly Hall, when members of the above teams attended to discourse upon their findings in German industry. The attendance was not all that could be desired, but the speakers gave useful information to member firms attending, and from the point of view of bringing all sections of the industry together technically the Conference was a success.

### Importation of Castings

In the early part of the year the question of importation of castings arose as a result of a desire by many manufacturers to import castings where delivery could not be secured in this country. As a result of deliberations with the Ministry of Supply, the C.F.A. ultimately offered no objection to the principle, providing an advisory panel was set up to consider applications as they were submitted. This panel has worked very satisfactorily. It has considered all applications, which, incidentally, have not been numerous, and has not rejected any. It is, however, continuing in being, because it acts as the medium by means of which these applications are analysed and has in its hands the opportunity to recommend rejection of applications as output in any section of the industry improves.

### Costing Report

During the year, the costing report has been finished and was sent to the printers in December. After many corrections and much editing, it is thought that the book will be produced in March, 1947. Much

(*Continued at foot of column* 1, *page* 272.)

# Patternmaking

*Mr. B. Levy's Paper, bearing the above caption, presented to the London Branch of the Institute of British Foundrymen, was printed in our last issue. The following is a report of the discussion which arose from the delivery of the lecture.*

## DISCUSSION

The President, MR. G. R. WEBSTER, said there was little doubt that this request for a Saturday afternoon meeting had been well justified, not only by the attendance but also by the lecture on a most ingenious machine.

### Human Reactions

MR. F. ARNOLD WILSON (Hon. Sec.) asked the author if he could say anything about the reaction of the skilled pattern maker to the advent of this machine.

MR. LEVY said he would not like to forecast the reactions of the individual pattern maker. All he could say was that in his own shop, in one or two cases, there had always been a bias against mechanisation of pattern making. However, here was a machine which would assist in dealing with the work which was very tedious and a source of possible error. As a pattern maker himself, he knew what a bugbear it was when endeavouring to make a reducing elbow or a reducing manifold to get even thickness of the metal, and he hoped that the response of the pattern maker would be one of enthusiasm. There was always the chance that it would be one of antagonism, but nevertheless this machine was a tool for the pattern maker to use and it could only be hoped that it would be accepted in that spirit.

### Checking Methods

MR. SMITH asked if there was any accurate method of checking the pattern made by this machine.

The Author said there was a very definite method of checking, *viz.*, by the actual templates used on the machine. If they fitted, that was the answer. The templates, in most cases, took the actual form aimed at, and therefore there was no further actual template to make. If one desired to line up the job on the surface plate, that was quite permissible. There was nothing against that. Otherwise, there was nothing to prevent the removal of the templates from the template table and trying them on the job. There was no elaborate set-up. The actual cut was taken in accordance with the follower and if, when the templates were put back on the template table they were found to be a little out of their former position, an adjustment of the machine would readily take that up. A further test before cutting could be made, if necessary, to make sure they were positioned accurately.

MR. SMITH said that he had a male form in mind.

MR. LEVY said that in the case of the male form, it was possible to have a female check. When cutting a male template there was nothing to prevent the cutting of a female template at the same time out of the one piece of material. He often did that. There was nothing to prevent the use of a female template on the machine to cut a male form.

### Restricted to Wood Patterns

MR. V. C. FAULKNER asked the author why he could not use this machine with hard metals. What was used for the balance weights, ropes or chains?

THE AUTHOR said the answer with regard to hard metal was feed and speed. He envisaged this pattern miller being used mainly for the materials that were most commonly used in pattern shops, which were generally woods and softer metals. He thought it should be recognised that if, in the case of cast iron and steel, the pattern had to be machined all over, it should go into the tool room and be a tool room job. He felt that the resistance of cast iron, even against a small cutter, would be so great as to give a rough surface and cause a certain amount of chatter on account of the suspension action used on this machine. He had not had the opportunity of trying this and therefore did not know, but they had machined cast iron with high speed tools and found that the work must be held very rigidly. In this particular set-up it would be appreciated that the work was not particularly rigidly held. Balance weights were used for maintaining the tension to the cutters and the vibration which was likely to be set up would not give a particularly good finish.

Replying to Mr. Faulkner's second question, he said that, in the Heath Robinson set-up in use at present, he was using an old chuck plate, a bit of a lathe head and, if some extra weights were needed, that was augmented with a further chuck plate out of an old lathe. The design in mind provided for lead weights and chain suspension, with the lead weights so arranged that they could be removed to obtain a good counterbalance suitable to the job in hand. In other words, the weights were adjustable. Together with his draughtsman, he had tested out weights as against spring tension and had decided on weights because these were constant, whereas the spring would be weakest at the point where the tension was most needed.

### Distance Limitations

MR. FEASEY said that from the lantern slide of the machine it would appear that the wheel would be unable to get to the back of the template, and therefore could not get its maximum distance. Another point arising from the illustration was whether the material was removed by hand or by cutter.

The Author said Mr. Feasey was quite right. He was glad the point had been raised, and it was provided for in the model on exhibit. As he had explained, the drawings he had shown were not too good.

With regard to the removal of material, he had tried to explain earlier on, that it all depended on whether templates or a full copy was used. If they were working off a full copy, there was nothing to prevent working up in sixteenths of an inch to get the complete shape. In this particular case, it was found more convenient to take the ledges off by hand.

MR. MCDOUGALL, referring to the same illustrations (Figs. 4 and 5), asked if there was any reason, when making a gear box with this apparatus, why the original templates made for the pattern should not be used. MR. LEVY said there was no reason why that should not be done.

MR. SELL asked what was the smallest size work which this machine would do.

THE AUTHOR said the immediate answer was that this machine was not suitable for small work, and that could be the subject to a separate Paper. It involved the question of a three-dimensional machine and fine work. In that respect he strongly urged those interested to study the Deckle machine. Indeed, although it was not generally known to the pattern-making fraternity, there were several machines available for tackling small work. There was the T.M.A., the Deckle, and the Gorton to mention one or two, the last being an American machine. They were all suited to three-dimensional work. In that case, however, they would not be able to employ templates as now. But he had purposely kept off small work because obviously the skilled patternmaker with his gouge and chisel would knock out a small pattern recess ½ in. by ½ in. in less time than it took to set up the job on a machine. Furthermore, therefore, from the practical point of view, it was not feasible to work off an actual drawing and work three-dimensionally. That was not really a practical proposition, although it was possible with the small machines he had mentioned. On the whole, the results, with the small machines on small work, would be no better than those obtained by the old hand methods. Therefore, the smallest dimensions he had considered were something like 12 in. by 3 in. by 3 in.

### Vote of Thanks

MR. V. C. FAULKNER, proposing a vote of thanks to the author, said he believed the first attempt to make a copying machine was by Leonardo da Vinci. Watt also made an attempt at it, as he had noticed during a visit to the Watt Museum in Birmingham some time ago.

MR. G. C. PIERCE (past-president) seconded, and remarked that he could see vast potentialities in the machine which Mr. Levy had described. It certainly provided a tool which would surprise, and possibly disappoint, the old patternmakers.

MR. LEVY, in acknowledgment, expressed appreciation of the way in which his Paper had been received, and said he presented the machine to the industry to make what they would of it. It could have remained a secret and kept by his firm, but it seemed to him that, if this country was to go forward and still carry the flag of industrial leadership, it might do some good if people put forward novel things like this.

## Council of Ironfoundry Associations

(*Continued from page* 270.)

difficulty has been encountered in the drawing up of this report. It has been necessary to prepare a costing system which will be suitable for all sections of the ironfounding industry. In other words, it has been necessary to present a system which would be simple enough to be adopted by the small ironfounders and yet have the merits for the consideration of the large ironfounders. It will be available to member firms free of cost and to non-member firms at a charge of 2 guineas per copy.

*CONDITIONS OF SALE*

After initial vetting by legal advisers and necessary corrections, the Standard Conditions of Sale were completed and approved by Council at their meeting in December. They are being distributed to member firms in 1947.

### Linseed Oil Shortage

During the year, many difficulties arose concerning the shortage of linseed oil. When the shortage first arose, many industries had their allocation of linseed oil reduced to 50 per cent. of their requirements and the ironfounding industry only received 60 per cent. of its needs. After meetings with the Raw Materials Authorities and representations to high levels, this allocation was increased to ironfounding by successive stages, until at the end of the year this industry was receiving its normal requirements. The allocation for the first few months of 1947 is considered adequate for present purposes.

It should be pointed out that this allocation to ironfoundries was only revised as a result of continual pressure on the available resources, and other industries, of course, had to suffer further cuts as a result of the increase given to ironfoundries.

### J.I.C. Convention

The J.I.C. Convention was held in November, and as a result a very interesting discussion took place on recruitment and particularly on training foundries. As a result of the discussion, the whole matter has been referred to the appropriate committee of the C.F.A. for consideration. This committee is sitting in 1947 on the question of providing training foundries for the industry, and expects to issue a report early in 1947.

### The Fuel Situation

The year 1946 closed with the gathering clouds of the fuel situation developing for the ironfounding industry. Supplies of foundry coke were difficult to obtain, although they were on the ground at the pithead. Transport was difficult owing to embargoes, and after negotiations with the Government Department concerned, a high priority was received for foundry coke wagons. This ensured considerable movement of foundry coke which met the situation. It was, however, apparent that a crisis was portending in 1947.

### General

The above are some of the main activities during 1946. It is not intended nor is it possible in this report to touch upon all the activities of the C.F.A. during the year. These have been fully described in the monthly issues of the two Bulletins. The Bulletins have been responsible for keeping firms up to date with all important developments, and ironfounders have expressed their interest in them by entering into discussions on subjects arising, thereby gaining information themselves and providing a stimulus to the work of the C.F.A. The importance of this co-operation cannot be overestimated, and ironfounders are requested to continue to seek help when desired on any matter, either through their local associations, or in the case of urgency, direct to the Secretary. It is only by the closest co-operation on all matters that the well-being and future of the industry can be assured.

The report is signed by Mr. T. E. Parkinson, the Secretary.

# House Organs

**Malleable Iron Facts,** Number 26. Published by the Malleable Founders' Society (U.S.A.).

This issue is devoted to showing how pearlitic malleable iron gears are of real interest to makers of agricultural implements.

**Sif-Tips,** house organ of the Suffolk Iron Foundry (1920), Limited, of Stowmarket, in the January issue just received, contains articles on the low temperature welding of aluminium alloys, the repair of tractor front wheels and farm implements.

**Foundry Practice,** house organ of Foundry Services, Limited, Long Acre, Nechells, Birmingham, 7, for November-December, 1946, has articles on simple die-casting moulds and the use of asbestos in the foundry.

**Crossley Chronicle,** issued by Crossley Bros., Limited, Manchester, 11, has resumed publication. This issue is devoted to an illustrated description of their own power station. They did not close down during the recent fuel crisis.

## A.F.A. Medallists

The American Foundrymen's Association will award four "meritorious service" gold medals and two honorary memberships at its 51st Annual Convention in Detroit, April 28-May 1.

The four honoured by the award of medals are.—Mr. Russell J. Allen, metallurgical engineer, Worthington Pump & Machinery Corp., Harrison, N.J., who receives the John A. Penton medal; Dr. Richard A. Flinn, is the recipient of the Peter L. Simpson medal; Mr. Harry M. St. John is to have the Wm. H. McFadden medal, whilst Mr. Henry M. Washburn (past president) has been selected to receive the Joseph S. Seaman medal.

Mr. John Grennan, instructor in foundry, University of Michigan, Ann Arbor, and Mr. Sheldon V. Wood, of Minneapolis, of the A.F.A., are to be inducted as honorary members.

## Eire Fuel Crisis

The Ironfounders' Association of Eire have issued the following statement:—"The Association is seriously alarmed at the acute fuel shortage. Two of the largest foundries are already closed and others do not anticipate being able to remain open much longer. The situation is so serious that the Association is requesting the Department of Industry and Commerce to meet representatives from the Association immediately with a view to stressing the urgency of the situation and placing before the Department the Association's suggestion as to how the situation could best be met.

# Publications Received

**The Engineering Centre.** Published from 351, Sauchiehall Street, Glasgow, C.2.

This 16-page, well illustrated, brochure describes a service to be given in Glasgow of a character similar to that performed by the Building Centre in London. It is to take the form of a permanent exhibition of engineering products. The building has four floors specially laid out for the purposes of an exhibition and ancillary services. The organisation has the co-operation of all the more important Scottish technical associations, including the Institute of British Foundrymen.

**Monthly Statistical Bulletin,** issued by the British Iron and Steel Federation for January. This issue has been somewhat delayed through the fuel crisis. It shows that the December weekly average for the production of steel for steel castings was 6,700 tons, as compared with 7,400 for November and 5,700 tons for December, 1945.

The employment in ironfoundries taken on November 9, 1946, showed that during the last month there was an intake of a further 1,100, of whom 976 were men and 134 women. The total has now reached 129,057, as compared with 102,736 a year ago.

**Starting from Scratch.** Published by Higgs Motors, Limited, Witton, Birmingham, 6.

This company, it seems, was established in 1912, and a period of 35 years is insufficiently long to be worthy of anything other than a celebration dinner. To give a history of the growth of a comparatively new concern, the reviewer believes that it is best portrayed by statistics and curves, and not—as has been done—by pictures of transformed conditions. Another fault is that whilst obviously the concern has grown, insufficient data are disclosed as to the extent. A few biographical notes of the people responsible for the development of the concern would have added interest. The reviewer cannot on this occasion award full marks.

## B.S. Specification for Boxwood Scales

This British Standard has been prepared in collaboration with the Drawing Office Material Manufacturers' and Dealers' Association, as one of the series of Standards relating to drawing office equipment and materials. Boxwood scales, and boxwood scales with celluloid edges, of oval, flat and triangular section are described and illustrated; the minimum and maximum values of the principal dimensions are listed; materials, workmanship, dividing and figuring are specified, and open divided and fully divided scales are defined and illustrated.

Architects', engineers' and surveyors' scales which are considered as standard scales, are tabulated in five tables, and these include decimal and metric scales. Recommended combinations of scales, or divisions of scales, follow and these include machine scales. The price of this British Standard is 2s. post free and copies can be obtained from the Publication Sales Department, British Standards Institution, 24, Victoria Street, London, S.W.1.

# Personal

MR. ALEXANDER S. MACLELLAN has been co-opted a director of Alley & MacLellan, Limited, Glasgow, and appointed chairman of the company in place of MR. S. J. L. HARDIE, who has retired.

MR. H. U. REDSHAW has been appointed general manager of the Crane Foundry Company, Limited, in succession to MR. J. A. RICHARDS, who, as reported recently, has resigned to take up an appointment in Scotland.

MR. H. R. PETERS, formerly sales promotion manager of Specialloid, Limited, has been appointed assistant general manager of the company. MR. E. S. BAILEY, formerly equipment manager, has been appointed home sales manager.

MR. E. A. FOWLER, of the Faculty of Technology, University of Manchester, has been appointed to succeed the late Dr. Donaldson as chief metallurgist and chemist with Scotts' Shipbuilding & Engineering Company, Limited, Greenock.

MR. T. H. SUMMERSON, chairman of Thomas Summerson & Sons, Limited, manufacturers of railway fixed plant, iron and steel founders, etc., of Darlington, has been elected to the Grand Council of the Federation of British Industries for 1947-50.

LORD SIMON OF WYTHENSHAWE is a member of the Royal Commission set up to inquire into the Press. He is chairman of the Fuel Advisory Council. He is governing director of Henry Simon, Limited, and Simon-Carves, Limited, and was raised to the peerage in the last New Year Honours List.

MR. P. B. JOHNSON, a director of R. & W. Hawthorn, Leslie & Company, Limited, and chairman of the Parsons and Marine Engineering Turbine Development Association, and MR. G. H. WRIGHT, joint general manager of the Neptune Works of Swan, Hunter & Wigham Richardson, Limited, have been elected Fellows of the North-East Coast Institution of Engineers and Shipbuilders.

DR. F. W. HAYWOOD, who has been appointed to the board of Wild-Barfield Electric Furnaces, Limited, as technical director, received his training at Loughborough College, where he was subsequently lecturer for seven years. From 1934 to 1938 he was associated with Imperial Chemical Industries, Limited, in work concerned with special metallurgical problems. He joined Wild-Barfield Electric Furnaces, Limited, in 1938 as chief metallurgist, the appointment also covering their associated company, G.W.B. Electric Furnaces, Limited. Dr. Haywood is the co-author of an acknowledged text book on the "Absorptiometer Analysis of Metals and Alloys," and has written numerous Papers covering various aspects of metallurgy. For an original thesis in 1931 on gaseous cementation relating to gas carburising, nitriding and allied problems, and controlled atmospheres, he was awarded the degree of Ph.D. (Lond.)

# Research and Industrial Recovery

## *F.B.I. Conference at Birmingham*

The subject of industrial research in relation to economic recovery was discussed in Birmingham last week at the first of a series of regional conferences organised by the Federation of British Industries. Sir Ernest Canning, vice-president of the F.B.I., who presided at the morning session, which was devoted to the national aspects of research, gave a warning that in two or three years' time at the latest the sellers' market would end. We should then have, he said, a highly competitive struggle in the world's markets to secure the requisite imports for this country. We could not possibly equip ourselves for that struggle if we postponed industrial research and its application until the time when the results were needed to strengthen our competitive power.

Sir William Larke, chairman of the Federation's Industrial Research Committee, suggested that the present shortage of coal and raw materials was such that our existing man-power could not remain in full employment in spite of the need for all classes of manufactured goods. On the Government of the day rested the responsibility of creating the conditions within which industry could get the fuel and raw materials, particularly as the latter were mainly imported, and to devise such distribution of available man-power as would enable industry at any time to utilise to the full the fuel and raw materials available. But it was upon industry that the responsibility rested for obtaining the maximum production from the resources of fuel, raw materials and man-power, he said. It was in this connection that an immediate and intensive application of industrial research was required.

Sir Edward Appleton, secretary of the Department of Scientific and Industrial Research, spoke of the increasing readiness on the part of many scientists in universities and technical colleges to place their knowledge at the disposal of industry. At the same time he was convinced that the most valuable support that could be given to industry in meeting its particular needs for scientific knowledge lay in the encouragement of co-operative action through the research associations.

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MR. P. W. HORT (with a committee of inspection), 28, Baldwin Street, Bristol, 1, has been appointed liquidator of Brooks & Blewitt (Electrical & General Engineers), Limited.

THE PARTNERSHIP BETWEEN Stanley Viccars, Ronald Watkin Jones, Arthur John Haggis, Douglas Kippax, Alfred Harry Protheroe, John William Protheroe, Eric Arthur William Haggis and Cecil Turner, carrying on business as general engineers and toolmakers, at 60A, Edwyn Street, Leicester, under the style of R. W. Jones, has been dissolved by mutual consent. Debts will be received and paid by S. Viccars, R. W. Jones, A. H. Protheroe and J. W. Protheroe, who will continue to carry on the business under the same style at Bradgate Road, Anstey, Leics.

# Distribution of Tin Metal

*Deterioration in Supply Position*

A second allocation of tin metal by the Combined Tin Committee for the first half of 1947 has been announced by the Ministry of Supply. When the Committee announced on January 23 the interim allocations of tin metal which had been recommended for the first half of 1947, it was stated that at a later date substantial additional quantities of tin would be available for allocation for the first half of this year. The estimates on which this statement was based have since been revised and show a deterioration in the supply position.

The rehabilitation of the mining industry in Malaya has been slower than anticipated, and current recovery of production has been seriously handicapped by a shortage of coal among other factors. Recovery of production in Netherlands Indies has also been retarded by shortages of coal as well as shipping facilities. Exchange problems have thus far made procurement of tin allocated during 1946 from Siam so difficult that it is not anticipated that Siam will be an effective source for new procurement during the first half of 1947. Of almost 10,000 tons of tin found in Japan, 6,000 tons have already been allocated by the Combined Tin Committee. The remaining quantity will be reported for allocation as soon as the protracted work of working and sampling is completed. Although it is expected that more tin will be available than hitherto, production in China is far below pre-war levels, owing to economic and transportation problems. Belgian production is reported to be increasing.

The Committee is not in a position to predict how soon the supply position will improve. It can only point out that the coal shortage may be temporary, and that the new equipment which is being provided for the Netherlands East Indies may be expected to increase output by the end of this year. The Committee points out that the relatively large allocations made in 1946 were possible because there were then available substantial stocks, including metal found in Malaya, Netherlands East Indies and Japan, at the end of the war. No such "windfalls" are likely to be available in 1947.

### Objective of Second Allocations

Demands for allocations for the period January to June, 1947, total almost 60,000 long tons, whereas new supplies available for allocation from all sources during this period total 17,700 tons. Since the first interim allocations for this period totalled 10,915 tons, there remain only 6,785 tons available for additional interim allocations. The Committee proposes to review the supply position again in May, at which time final allocations for the first half of 1947 will be recommended. There may by that time be a further quantity available for allocation from Japanese stocks.

In announcing additional allocations for the first half of 1947, the Committee explains why no further allocations have been recommended to many claimant countries. The quantities made available were based arbitrarily on the allocations for the second half of 1946 and were intended primarily to keep supplies moving. It was not then possible to ensure an equitable distribution because many countries had not submitted adequate data in support of their stated requirements. The new interim allocations are designed to bring the relative positions of the claimant countries more nearly in balance. Under this determination many countries have already received the calculated allotment due to them.

The following details (in long tons) are of the first and second interim allocations respectively:—Argentina, 100 (nil); Austria, 115 (nil); Brazil, 115 (nil); Canada, 680 (360); Ceylon, nil (14); Czechoslovakia, 340 (8); Denmark, 140 (20); Egypt, 100 (nil); Finland, 70 (6); France, 2,275 (149); Greece, 45 (15); Hong Kong, 150 (nil); India, 1,140 (nil); Italy, 455 (485); New Zealand, 150 (nil); Norway, 70 (2); Poland, 205 (20); Sweden, 390 (10); Switzerland, 365 (nil); Turkey, 100 (10); U.S.A., 3,640 (5,686); Yugoslavia, 90 (nil); other Latin American, 80 (nil); other Middle East (including Palestine), 100 (nil); total, 10,915 (6,785).

Supplies may be obtained from the Netherlands and Netherlands East Indies, Belgium and the Belgian Congo and China, as well as from stocks of Japanese tin in the United States. Malaya and Hong Kong are not sources of supply for the second interim allocations since requests already put before the British authorities against the first interim allocation would completely absorb the quantity estimated as available to the end of June from these sources.

All the eight countries represented at the international tin conference in London last October have now indicated their acceptance of the proposal to form a Tin Study Group. The countries concerned are:—Belgium, Bolivia, China, France, Netherlands, Siam, United Kingdom, and the United States.

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# South Wales Steel Plan Delay

In a letter to Mr. W. G. Cove, M.P. for Aberavon, Mr. John Wilmot, Minister of Supply, intimates that two or three years must elapse before even the first stages of the £50,000,000 scheme for the development and modernisation of the steel and tinplate industry in South Wales can be in operation, and some five years before the scheme can be in full operation. He says that there has been no delay on the part of any Government department, but the magnitude of the scheme and the fact that it will decide in the main the pattern of sheet and tinplate production in South Wales—"indeed in the United Kingdom"—for a great many years to come warrants the Iron and Steel Board's most careful consideration of all relevant questions before reaching a conclusion.

It is understood that the expansion schemes of Richard Thomas & Baldwins, Limited, and Stewarts and Lloyds, Limited, were discussed at a meeting of the National Steel Board last week.

# Imports and Exports of Iron and Steel

## BOARD OF TRADE RETURNS FOR FEBRUARY

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in February and in the first two months of 1947. Figures for one-sixth of 1938 are given for purposes of comparison.

### *Total Exports of Iron and Steel.*

| Destination. | February, 1947. | Two months ended February. | One-sixth of 1938. |
|---|---|---|---|
| | Tons. | Tons. | Tons. |
| Eire | 5,606 | 11,552 | 9,286 |
| Channel Islands | 230 | 681 | 1,236 |
| Malta and Gozo | 130 | 599 | 384 |
| Cyprus | 236 | 343 | 276 |
| Palestine | 5,612 | 11,211 | 1,346 |
| British West Africa | 3,796 | 9,138 | 8,290 |
| Union of South Africa | 11,833 | 27,768 | 38,512 |
| Northern Rhodesia | 402 | 582 | 3,428 |
| Southern Rhodesia | 1,829 | 4,301 | 6,036 |
| British East Africa | 1,857 | 3,888 | 4,322 |
| British India | 6,083 | 14,119 | 26,444 |
| Burma | 3,529 | 8,351 | 3,086 |
| British Malaya | 2,552 | 9,162 | 11,098 |
| Ceylon | 451 | 1,801 | 4,338 |
| Hong Kong | 1,101 | 3,201 | 3,932 |
| Australia | 2,500 | 7,514 | 28,482 |
| New Zealand | 3,111 | 8,211 | 21,980 |
| Canada | 341 | 791 | 14,234 |
| British West India Islands | 2,085 | 6,354 | 7,374 |
| Anglo-Egyptian Sudan | 713 | 831 | 1,392 |
| Other British Countries | 4,025 | 7,105 | 2,992 |
| Soviet Union | 45 | 410 | 724 |
| Finland | 3,104 | 7,181 | 2,934 |
| Sweden | 5,118 | 14,904 | 1,996 |
| Norway | 2,918 | 7,950 | 3,378 |
| Iceland | 452 | 1,186 | 110 |
| Denmark | 4,661 | 14,723 | 14,542 |
| Poland | 18 | 71 | 414 |
| Netherlands | 7,419 | 16,500 | 8,594 |
| Belgium | 3,230 | 5,435 | 3,388 |
| Luxemburg | 1 | 402 | 17 |
| France | 1,447 | 3,618 | 2,232 |
| Switzerland | 1,023 | 2,099 | 464 |
| Portugal | 897 | 3,431 | 1,286 |
| Spain | 330 | 1,257 | 1,294 |
| Italy | 15 | 26 | 856 |
| Greece | 1,298 | 4,407 | 292 |
| Turkey | 1,104 | 2,290 | 2,292 |
| Dutch East Indies | 537 | 2,330 | 4,552 |
| Dutch West India Islands | 1,176 | 2,274 | 410 |
| Belgian Congo | 179 | 421 | 51 |
| Portuguese East Africa | 378 | 911 | 2,370 |
| Syria | 479 | 878 | 434 |
| Egypt | 3,396 | 8,337 | 5,734 |
| Iraq | 4,574 | 11,684 | 4,290 |
| Iran | 3,932 | 11,347 | 18,394 |
| China | 3,334 | 6,809 | 3,751 |
| U.S.A. | 2,856 | 4,172 | 364 |
| Colombia | 466 | 1,919 | 637 |
| Venezuela | 2,301 | 5,155 | 780 |
| Ecuador | 227 | 398 | 266 |
| Peru | 524 | 738 | 505 |
| Chile | 439 | 1,215 | 1,048 |
| Brazil | 3,122 | 7,388 | 2,832 |
| Uruguay | 246 | 911 | 1,264 |
| Argentine | 4,907 | 10,057 | 13,226 |
| Other Foreign Countries | 7,742 | 11,995 | 15,117 |
| Total | 131,917 | 312,332 | 319,312 |

THE BOARD OF TRADE have appointed Mr. J. H. Ewing as head of an official mission in Tokyo to be in charge of sales to, and purchases from, Japan, made on Government account on behalf of the United Kingdom, the Colonies, and certain other areas.

### *Total Imports of Iron and Steel.*

| From | February, 1947. | Two months ended February. | One-sixth of 1938. |
|---|---|---|---|
| | Tons. | Tons. | Tons. |
| British India | 505 | 505 | 25,936 |
| Australia | 4,473 | 5,974 | 6 |
| Canada | 19,981 | 23,798 | 19,562 |
| Other British Countries | 77 | 660 | 932 |
| Sweden | 745 | 1,530 | 14,966 |
| Norway | 1,963 | 4,832 | 5,628 |
| Belgium | 1,984 | 3,001 | 45,612 |
| Luxemburg | 765 | 765 | 9,766 |
| France | 47 | 120 | 42,892 |
| U.S.A. | 14,431 | 27,593 | 33,448 |
| Other Foreign Countries | 2,041 | 3,914 | 25,288 |
| Total | 47,012 | 72,692 | 224,046 |
| Iron ore and concentrates— | | | |
| Manganiferous | 8,970 | 18,070 | 10,380 |
| Other sorts | 392,588 | 957,213 | 850,312 |
| Iron and steel, scrap and waste, fit only for the recovery of metal | 16,271 | 31,375 | 105,368 |

### *Exports of Iron and Steel by Products.*

| Product. | February, 1947. | Two months ended February. | One-sixth of 1938. |
|---|---|---|---|
| | Tons. | Tons. | Tons. |
| Pig-iron | 6,074 | 11,706 | 15,656 |
| Ferro-alloys, etc.— | | | |
| Ferro-tungsten | 25 | 66 | 86 |
| Spiegeleisen and ferro-manganese | 1,966 | 6,195 | 866 |
| All other descriptions* | 30 | 104 | 174 |
| Ingots, blooms, billets and slabs | 124 | 156 | 1,624 |
| Iron bars and rods | 345 | 786 | 532 |
| Sheet and tinplate bars | — | — | 2,064 |
| Wire rods | 367 | 608 | 530 |
| Bright steel bars | 1,952 | 4,692 | 1,098 |
| Other steel bars and rods | 11,668 | 28,903 | 17,000 |
| Special steel | 1,154 | 2,717 | 822 |
| Angles, shapes and sections | 6,686 | 17,134 | 11,146 |
| Castings and forgings | 294 | 664 | 270 |
| Girders, beams, joists and pillars | 2,374 | 6,441 | 5,578 |
| Hoop and strip | 1.957 | 6,523 | 6,230 |
| Plates, ¼ in. thick and over | 9.392 | 24,125 | 21,826 |
| Black plates | 943 | 4,480 | 2,422 |
| Black sheets | 2,675 | 5,869 | 10,584 |
| Galvanised sheets | 2,577 | 7,210 | 24,488 |
| Tinplates | 7,485 | 21,315 | 53,216 |
| Tinned sheets | 209 | 364 | 234 |
| Terneplates | 38 | 154 | 720 |
| Decorated tinplates | 546 | 669 | 728 |
| Cast-iron pipes, up to 6-in. dia. | 4,655 | 8,466 | 8,154 |
| Do., over 6-in. dia. | 3,003 | 6,226 | 7,160 |
| Wrought-iron tubes | 20,754 | 42,875 | 36,664 |
| Radiators and central-heating boilers | 281 | 667 | 671 |
| Steel rails | 4,957 | 14,532 | 17,666 |
| Sleepers and fishplates | 5,002 | 8,573 | 4,230 |
| Spikes | 377 | 700 | 468 |
| Signalling equipment | 496 | 1,212 | 209 |
| Other railway material | 924 | 2,517 | 3,785 |
| Wire | 3,703 | 10,843 | 9,198 |
| Cable and rope | 1,986 | 3,979 | 2,734 |
| Netting, fencing and mesh | 1,277 | 2,132 | 1,570 |
| Other wire manufactures | 524 | 1,524 | 612 |
| Nails, tacks, etc. | 644 | 1,313 | 634 |
| Rivets and washers | 640 | 1,310 | 1,422 |
| Wood screws | 414 | 736 | 418 |
| Bolts, nuts, and metal screws | 1,519 | 3,950 | 2,928 |
| Stoves, grates, etc. (excl. gas) | 382 | 931 | 1,167 |
| Sanitary cisterns | 50 | 123 | 468 |
| Fencing material | 125 | 581 | 854 |
| Anchors, etc. | 683 | 1,527 | 1,056 |
| Chains | 643 | 1,581 | 1,048 |
| Springs | 350 | 870 | 656 |
| Hollow-ware | 5,058 | 10,745 | 1,774 |
| All other manufactures | 14,589 | 33,538 | 35,846 |
| Total | 131,917 | 312,332 | 319,312 |

* The figures for 1938 are not completely comparable with those for subsequent years.

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# Company News

*(Figures for previous year in brackets.)*

**Burt, Boulton & Haywood**—Interim dividend of 2% (same).

**Renold & Coventry Chain Company**—Interim dividend of 3% (same).

**Wheal Reeth Tin**—Net loss for 1945, £2,441 (£1,902), increasing debit forward to £30,552.

**Metropolitan Electric Cable & Construction Company**—Final dividend of 10%, making 15% (same).

**Thomas Robinson & Son**—Net profit for 1946, £33,776 (£30,355); dividend of 7½% (same); forward, £48,906 (£45,130).

**Hadfields**—Final dividend of 12½% (same), making 17½% (20%), and capital bonus of 2½%, tax free, from capital profits reserve (nil).

**L. Gardner & Sons**—Profit for 1946, after tax and depreciation, £111,930 (£58,740); dividend of 50% (same); forward, £301,487 (£248,552).

**Superheater Company**—Final dividend of 27½%, making 42½% (same) and bonus of 2%, tax free, from surplus of realisation of investments.

**Evered & Company**—Profit for 1946, £41,195 (£28,574); to general reserve, £25,000 (£15,000); dividend of 15% (same); forward, £24,521 (£22,419).

**Waste Heat & Gas Electrical Generating Stations**—Profit to January 31, £10,981 (£8,758); to general reserve, £2,138 (£2,292); dividend of 8% (same); forward, £19,084 (£19,041).

**John C. Parkes & Sons**—Net profit for 1946, £12,236 (£9,647); final dividend of 1s. per share, making 1s. 6d. per share (same) and bonus of 6d. per share (nil); forward, £18,557 (£16,125).

**Westwood, Dawes & Company**—Net profit for 1946, after tax, deferred repairs and depreciation, £8,660 (£7,141); dividend of 15% (same); general reserve, £5,000 (same); forward, £7,702 (£8,167).

**Arnott & Harrison**—Net profit for the year ended June 30, after income-tax, etc., £18,816 (£23,060); to contingencies, £2,000 (£3,000); general reserve, £5,000 (£7,000); dividend of 20% (same); forward, £14,894 (£14,628).

**Federated Foundries**—Net profit for 1946, after depreciation and taxation, £41,656 (£27,104); to additional depreciation, £7,500 (£5,000); goodwill reserve, £5,000 (nil); dividend of 3¼% (2½%); forward, £46,292 (£44,299).

**Alfred Herbert**—Net profit to October 31, £362,741 (£461,379); profit on investments realised, £58,494 (nil); dividend of 11% (15%), tax free, and special capital dividend of 9% (5%), tax free; forward, £3,318,943 (£3,035,629).

**Royles**—Net profit for 1946, £13,475 (£16,947); from investments, £2,119 (£1,999); to employees' profit-sharing scheme, £5,776 (£6,049); reserve, nil (£2,000); dividend of 13% and bonus of 4% (same); forward, £41,177 (£40,709).

**Lobnitz & Company**—Net profit for 1946, after depreciation, taxation, etc., £19,922 (£16,626); written off special repair expenditure, £5,000 (nil); dividend of 8% (4%); funding certificates redemption, nil (£14,479); forward, £13,508 (£9,448).

**Switchgear & Cowans**—Net profit for 1946, after depreciation and taxation, £1,584 (£20,376); to pension fund, nil (£1,000); transferred from war contingencies, £5,000; to reserve, nil (£2,000); dividend of 10% (20% and bonus of 5%); forward, £22,252 (£22,268).

**P. & W. Maclellan**—Net profit for 1946, after fees, taxation and contingencies, £57,904 (£47,382); to debenture interest, £6,561 (same); depreciation, £10,000 (same); repairs, £4,000 (nil); reserve, £10,000 (same); dividend of 7% (6%); forward, £12,674 (£9,271).

**Davis & Timmins**—Net profit for 1946, after providing for taxation, etc., £42,388 (£39,192); to pension fund, £3,000 (£2,000); stock contingency provision, £10,000 (nil); final dividend of 20%, making 30% (same, plus victory bonus of 10%); forward, £78,734 (£69,421).

**Beans Industries**—Profit for the year ended November 30, after income-tax, but including £6,833 (nil) net E.P.T. repayable, £44,082 (£43,350); to directors' fees, £1,675 (£2,900); general reserve, £10,000 (£15,000); final dividend of 27½%, making 37½% (same); forward, £36,992 (£28,235).

**Super Oil Seals & Gaskets**—Net profit for 1946, after depreciation, tax, etc., £28,419 (£21,690); final dividend of 25%, making 40% (same); directors' extra remuneration, £1,421 (£1,084); general reserve, £5,000 (£10,000); bad and doubtful debts reserve, £1,500 (nil); forward, £10,134 (£5,036).

**Richard Lloyd**—Net profit for 1946, including E.P.T. recoverable, after providing for income-tax and directors' fees, £21,103 (£17,079); dividend of 20% (same); to contingency reserve, £10,000 (£5,000); special reserve interest on tax reserve certificates, £242 (£517); forward, £15,332 (£13,810).

**Midland Electric Manufacturing Company**—Net profit for 1946, after tax, etc., £59,066 (£61,948); interest on tax certificates, £945 (£3,232); dividend of 20% (15%) and bonus of 15% (same); to development reserve, £5,000 (£20,000); general reserve, £20,000 (same); forward, £38,729 (£35,687).

**Blythe Colour Works**—Profit for 1946, £151,647 (£84,200); to income-tax and E.P.T., £92,000 (income-tax and N.D.C., £41,441); final dividend of 30% and bonus of 30%, making 80% (50%, less tax, and victory bonus of 15%, tax free); general reserve, £20,000 (£8,000); forward, £17,878 (£14,380).

**Parker, Winder & Achurch**—Net profit for 1946, £28,966 (£17,059); profit on sale of investments and property, £1,325 (nil); to general reserve, £5,000 (same); pensions, £7,500 (nil); dividend equalisation reserve, £5,000 (nil); dividend of 10% (same) and bonus of 10% (same); forward, £31,450 (£28,295).

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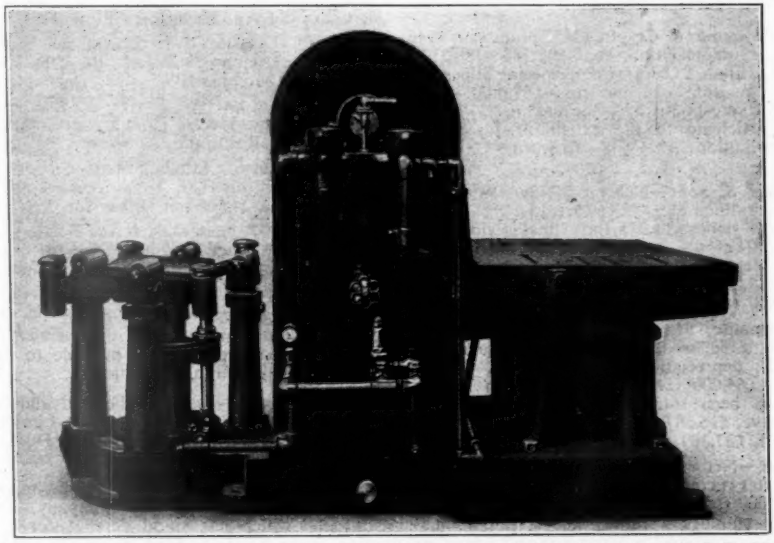

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**Small & Parkes**—Net profit for the year ended November 30, after depreciation, income-tax, E.P.T., etc., £40,983 (£24,484); to reserve, £15,000; stock depreciation reserve, £4,000; benevolent fund, £1,000; final dividend of 10% and bonus of 5%, making 25%, less tax (10%, tax free); forward, £23,565 (£20,305).

**S. Guiterman**—Profit for 1946, £43,068 (£24,423); to tax provision, £27,500 (£10,000); share conversion expenses, £3,137 (nil); dividend of 12½% (10%) and bonus of 7½% (5%); general reserve, £3,000 (same); special war contingencies reserve, nil (£1,000); employees' welfare fund, £1,000 (same); forward, £18,774 (£18,698).

**Lancashire Dynamo & Crypto**—Net profit for 1946 after income-tax, depreciation, etc., £92,382 (£88,317); to staff pension fund, £3,000 (same); special allocation for new staff pension scheme, nil (£27,000); final dividend of 10% and bonus of 7½%, making 22½% (the new shares participate to the extent of three-fifths of this distribution (22½%); forward, £173,193 (£139,131).

**Josiah Parkes & Sons**—Net profit for 1946, after depreciation, taxation, etc., £23,674 (£15,448); surplus on life assurance policy, £1,975 (nil); final dividend on increased capital of 6% and bonus of 2½%, making 12½% (10%); deferred repairs, £4,000 (nil); taxation reserve, nil (£8,000); general reserve, £6,000 (nil); forward, £13,160 (£10,161).

**Barrow Hematite Steel Company**—Trading, etc., profit for 1946, £158,869 (£123,799); to directors' fees, £1,777 (£1,662); depreciation of fixed assets, £35,000 (£30,000); tax, £64,000 (£44,800); profit from sale of investments has been transferred to general reserve; to general reserve, £15.587 (£20,000); dividend of 12½% (10%); forward, £37,369 (£43,487).

**Brown Bros.**—Net profit for the year ended January 16, after taxation, etc., £142,094 (£114,292); to reserve, £25,000 (same); war contingencies provision, £25,000 (same); employees' funds, £5,000 (same); final dividend of 12½%, making 15% (same); special tax-free Jubilee bonus of 3% from profits on realisation of investments; forward, £146,897 (£114,030).

**Gibbons (Dudley)**—Net profit for 1946, after taxation and depreciation, £43,688 (£34,268); dividend of 10% and bonus of 5% (same); to general reserve, £5,000 (same); deferred repairs and renewals, £15,000 (£10,000); buildings and kilns, £3,000 (nil); dividend equalisation, £3,678 (nil); employees' benefit fund, £3,678 (£3,344); written off buildings and plant, nil (£3,000); forward, £21,079 (£21,781).

**National Gas & Oil Engine Company**—Trading profit for 1946, £52,895 (£78.683); income from investments, £1,223 (£1,695); profit on repayment of investments, £369; E.P.T. recoverable, £15,000; reserve for contingencies no longer required, £5,151; to directors' fees, £1,000 (same); depreciation of buildings and plant, £19,444 (£18,478); staff pension scheme, £4,665 (£4,773); reserve for income-tax, £8,250 (£7,500); E.P.T., nil (£1,500); dividend of 5% (same); forward, £39,519 (£39,240).

# *News in Brief*

RAILS HALF A MILE LONG are to be introduced by the L.P.T.B. on the Underground lines.

THE METAL BOX COMPANY, LIMITED, are planning extensions to their works at James Street, Carlisle.

THE ENGINEERING CENTRE, which, as already announced, is to be set up in Glasgow, will be opened towards the end of the summer.

STOCKTON-ON-TEES CORPORATION has accepted the tender of Whessoe, Limited, at £8,750 for the erection of a gasholder at Haverton Hill-on-Tees.

DAMAGE ESTIMATED AT £2,000 has been caused by fire in the welding shop of the Cleveland Bridge & Engineering Company, Limited, Darlington.

DORMAN, LONG & COMPANY, LIMITED, and two London companies are participating in the flotation of the Harbour Restoration Company, of Rotterdam.

THE FURNESS SHIPBUILDING COMPANY, LIMITED, Haverton Hill-on-Tees, have received an order from Norway for a 24,500-ton tanker for delivery in 1950.

FREDERICK PARKER, LIMITED, Leicester, have secured a £45,000 contract for the supply of three complete gravel-handling plants and other machinery for a new hydro-electric plant in Portugal.

THE DIRECTORS OF Wheal Reeth Tin, Limited, the Cornish tin-ore mine owners, state that their mines remain closed and it is not possible to restart operations under prevailing conditions.

NINETY-NINE MEMBERS of the staff and operatives of the Dunlop Rim & Wheel Company, Limited, Coventry, and W. Goodyear & Sons, Limited, Dudley, complete 25 years' service, or more, this year.

THE THREE-UNIT BLAST-FURNACE PLANT of the Linthorpe-Dinsdale Smelting Company, Limited, near Dinsdale, which has stood derelict for a number of years, is to be dismantled by W. H. Arnott, Young & Company, Limited.

A. C. WICKMAN, LIMITED, Coventry, have been appointed sole agents in this country, the British Empire and Europe (excluding Russia) for "Hufford" hydraulic stretch-forming machines, manufactured by Hufford Machine Works, Inc., California.

OLDHAM & SON, LIMITED, manufacturers of miners' electric safety lamps, electric storage batteries, and electrical equipment, and general engineers, of Denton, near Manchester, are to apply for permission to deal in the whole of the issued share capital of the company. The authorised capital is £120,000 in 1s. ordinary shares, of which £100,000 is issued and fully paid. No mortgages, debentures or loan capital are outstanding. The business was founded over 80 years ago. It is intended later to raise additional working capital to finance an expanding volume of business. The company is at present producing over four times its pre-war volume of products in each of its three main departments.

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# *Raw Material Markets*

## Iron and Steel

Most of the difficulties caused by the fuel crisis and the transport hold-up consequent on the bad weather having been surmounted, the foundries are back into their stride again, but a new threat arises from the suggestion to turn over some of the blast furnaces from foundry iron to basic. The high-phosphorus pig-iron required by the foundries making light castings is by no means plentiful as it is, and any curtailment of supplies must be reflected in the output of castings. Although a fair supply of builders' castings has been built up in readiness for the spring drive in housing construction, the call for castings of this nature is almost insatiable. Many other trades also require light castings and a falling off in the supply will be felt throughout a wide range of industrial activities. The general engineering and jobbing foundries also are very busy and they are finding supplies of hematite, medium- and low-phosphorus pig-iron and refined iron none too plentiful.

The call for scrap will be intensified if less pig-iron is available and it is to be hoped that the necessary quantities will be found. Coke is now coming through at a much better rate following the recent transport delays. Supplies of ganister and limestone have been short because of difficulties of extraction during the period of bad weather, but there should be improvement from now on.

The steel trade remains as busy as ever. Output this month should show an improvement because of the extended period of melting operations as from April 6, in accordance with the agreement for week-end working. This will make more steel available for the finishing mills which have orders in hand capable of absorbing the production for many months to come. Unfortunately, the mills are still encountering difficulties in getting away the tonnage already rolled. Many loading banks are still filled to capacity and even since the worst of the transport difficulties were overcome there have had to be stoppages of production owing to inability to find room for more finished material. However, it should be possible now gradually to clear the loading banks and allow operations to go on unimpeded. It transpires that only a small percentage of the steel which is to be imported from Belgium over the next 12 months will be in semi-finished form and the additional steel to be secured from week-end working will therefore be all the more valuable. There is an insistent demand throughout the range of finished steel products. Plates especially are called for and there is no easing of the unprecedented flow of business for sheets. Sections, joists and bars are equally in demand, while rail and wire mills have more orders than they can accomplish and give reasonable delivery periods. Makers of special steels now have ample business on hand.

## Non-ferrous Metals

Prices of copper, tin and lead have been increased. Under the Control of Non-ferrous Metals (No. 28) (Copper, Lead and Zinc) Order, 1947, which came into effect on March 31, the maximum price of copper was raised by £10 per ton, from £127 to £137 in the case of high-conductivity electrolytic copper, and of lead by £20 per ton—from £70 to £90—for good, soft pig-lead, Empire and domestic. Prices for other descriptions of copper and lead are correspondingly adjusted. Prices of zinc and zinc products are unchanged.

As from March 29, the price of tin metal of minimum 99 per cent. up to under 99.75 per cent. tin content was increased from £380 10s. to £437 per ton, f.o.b. U.K. port or delivered U.K. consumers' works. All other prices were varied correspondingly.

It is not expected that there will be a prolonged Easter stoppage in the non-ferrous metals industry. Recent buying has been on quite a good scale, with the tendency to stipulate delivery after the holiday.

## Death of Mr. A. E. Lee

Mr. Arthur Edgar Lee, advertisement manager of the FOUNDRY TRADE JOURNAL and editor of *Ryland's Directory*, died suddenly on March 28 at his home in Surrey. He was 65 years of age. Mr. Lee had been engaged in the publishing trade all his working life. He died in harness. His was a quiet and unassuming personality that made friends slowly but held them staunchly once they were established. Among them were all his colleagues on the JOURNAL. To the publications he served, in which his work is enshrined, his death is a great loss.

A SECTIONAL MEETING of the World Power Conference is to be held at The Hague from September 2 to 9.

THE BRIGHTSIDE FOUNDRY & ENGINEERING COMPANY, LIMITED, have opened a new branch office at Palatine House, 76, Victoria Street, Manchester (telephone: Blackfriars 7318).

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